AD-A120 499 GRAND TRAVERSE BAY HOUGHTON COUNTY MICHIGAN LAKE SUPERIOR OPERATION AND M..(U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT MAY 75 1/1

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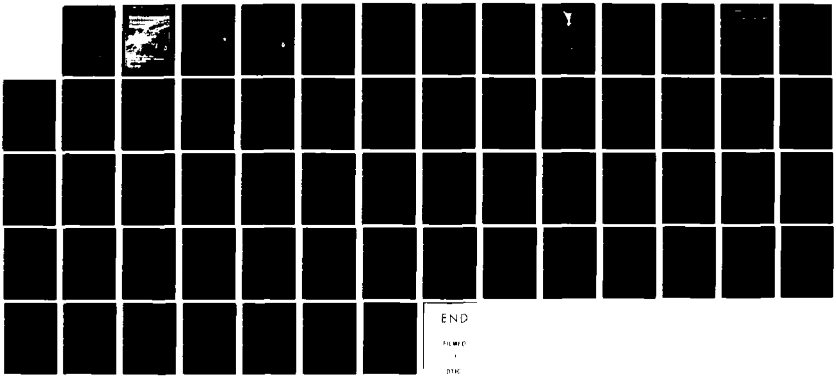

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Big Traverse Bay

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Regular operation and maintenance activities at Grand Traverse Bay Harbor involve two parallel breakwaters and a harbor basin constructed at right angles to the entry channel. A boat launching ramp was constructed by the State of Michigan in 1972. Maintenance of the breakwaters, dredging, and dredged material disposal do not significantly affect the environment. The harbor has been declared unpolluted by the U.S. Environmental Protection Administration, and open-lake disposal of dredged material and beach nourishment will continue.

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ENVIRONMENTAL ASSESSMENT REPORT

OPERATION AND MAINTENANCE ACTIVITIES
GRAND TRAVERSE BAY HARBOR
HOUGHTON COUNTY, MICHIGAN
LAKE SUPERIOR

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
St. Paul, Minnesota

ENVIRONMENTAL ASSESSMENT REPORT
OPERATION AND MAINTENANCE ACTIVITIES
GRAND TRAVERSE BAY HARBOR
HOUGHTON COUNTY, MICHIGAN
LAKE SUPERIOR

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GRAND TRAVERSE BAY HARBOR
HOUGHTON COUNTY, MICHIGAN
LAKE SUPERIOR

INTRODUCTION

The purpose of this study is to assess the environmental effects associated with the St. Paul District, Corps of Engineers harbor operation and maintenance activities at Grand Traverse Bay Harbor. This assessment has been drawn in part from an environmental report prepared by National Biocentric, Inc. and a shoreline process study prepared by Michigan Technological University, both under contract with the Corps of Engineers. Although various State and County maps refer to the harbor as "Traverse Bay" or "Big Traverse Bay", the Corps of Engineers has designated the harbor "Grand Traverse Bay Harbor" in the past and, for the purpose of this study, that nomenclature will be used.

1.000 PROJECT DESCRIPTION

1.100 Project Location - Grand Traverse Bay Harbor is located at the mouth of the Traverse River in Schoolcraft Township, Houghton County, Michigan, on the eastern side of the Keweenaw Peninsula, approximately 18 miles northeast of the lower entrance to the Keweenaw Waterway. The fishing port of Traverse Bay lies along both flanks of the harbor and along the Traverse River from the mouth to 0.3 mile upstream (figures 1 and 2).

1.200 Project Purposes - The harbor serves two basic functions. It is a harbor-of-refuge for recreational craft and serves as a base of operations for commercial fishing craft.

1.300 Project Authorizations - The project was authorized by the 1945 River and Harbor Act, and construction of the harbor was initiated at that time. Erosion studies are being conducted under the authority of section 111, Public Law 90-483, the River and Harbor Act of 1968. These studies were requested by the Michigan Department of Natural Resources in a letter dated 16 March 1971 and the shoreline erosion study was initiated on 14 January 1972.

1.400 Existing Project - The Grand Traverse Bay Harbor project was completed in 1950 and included two parallel breakwaters oriented northwest-southeast, extending from land into Grand Traverse Bay. The south breakwater extends straight bayward for 567 feet. The north pier parallels the south breakwater, but at a point just lakeward of the south pierhead it doglegs to the southeast for a

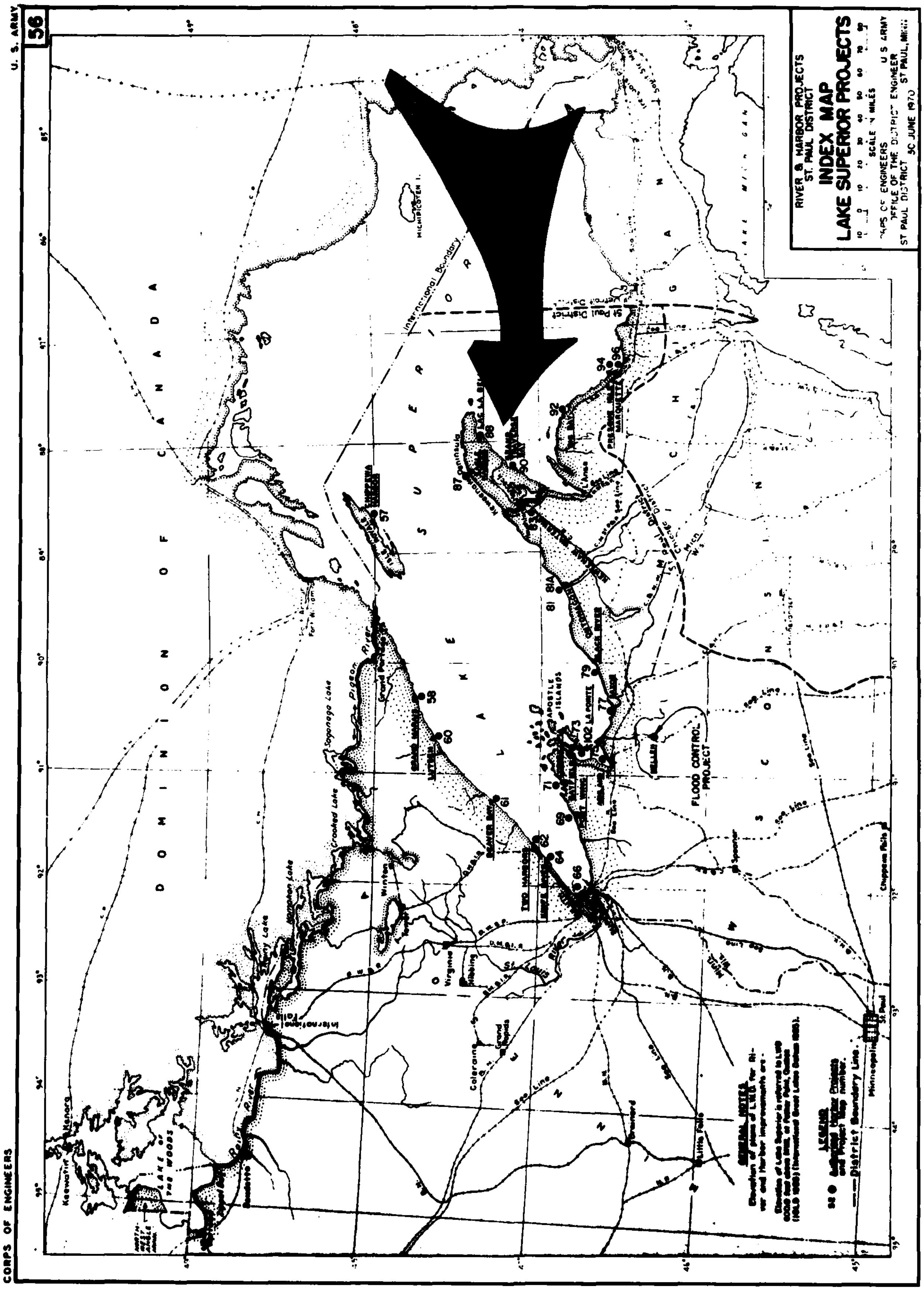


FIGURE 1

FIGURE 1

CORPS OF ENGINEERS

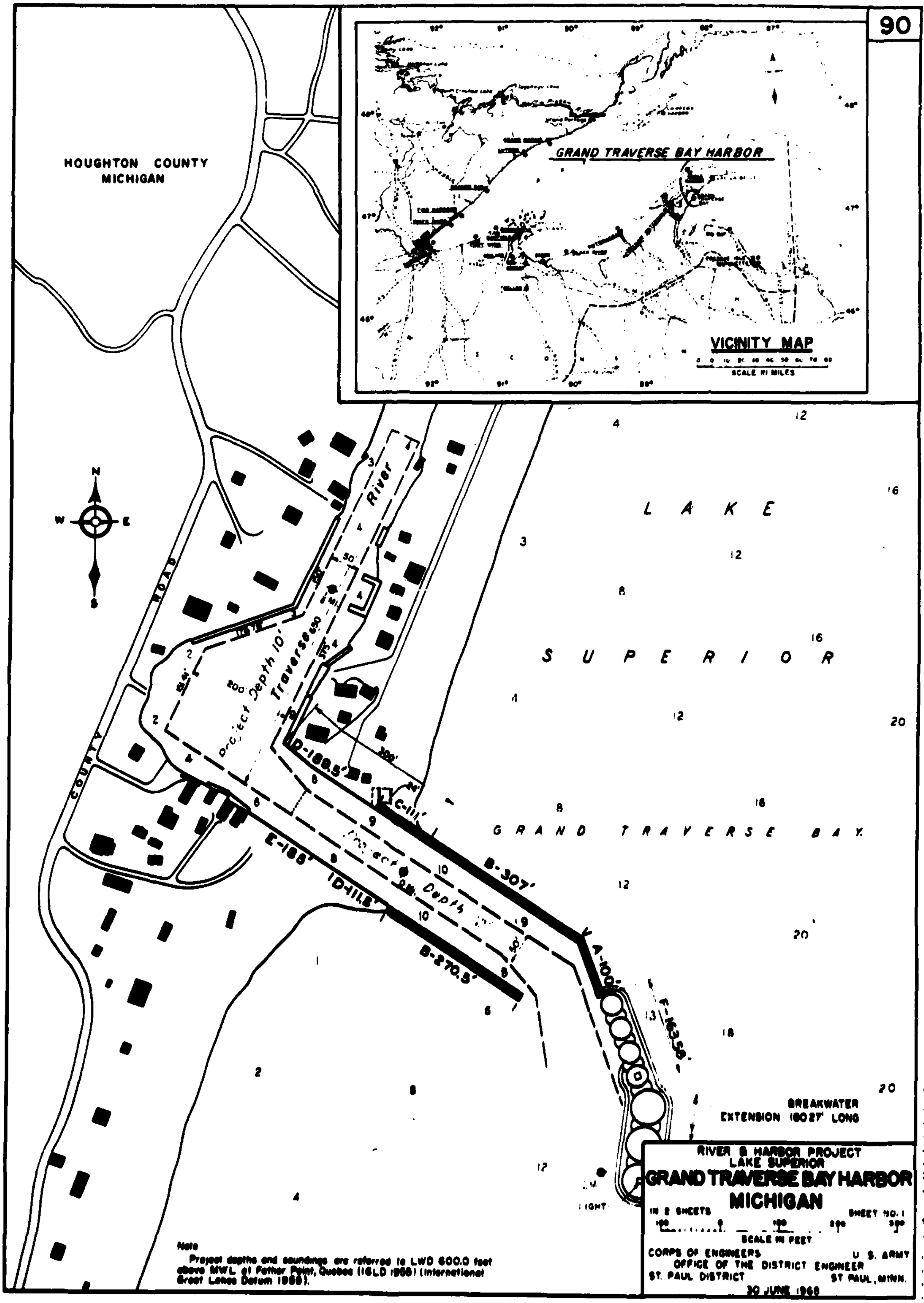


FIGURE 2

distance of 100 feet. The original length of the north pier was 698 feet as constructed. In 1964, the north breakwater was extended 163 feet by the addition of steel sheet pile cells. In 1973 the north breakwater was extended an additional 180 feet to further protect the harbor from damaging northeasterly winds.

1.401 The south breakwater consists of a 270-foot section of Z-type sheet steel piling filled with sand and capped with bituminous concrete. There are rubble mounds at its base on either side (figure 3). Harborward is a 111-foot section of Z-type sheet steel revetment with a rock surface. Further into the harbor is a 185-foot section of round pile revetment with wakefield sheet pile landward. This is also capped with rock.

1.402 The north breakwater consists of an outer section of circular piling (cells) approximately 340 feet long. These are constructed of SA-23 piling and filled with sand; capping is 2 feet of rock filled with grout. The cells are 30-60 feet in diameter and have gravel bedding with rock berm at their base. Harborward from this are a 100-foot and 307-foot breakwater. The former is Z-type sheet steel piling filled with sand and capped with 2+ ton rocks over smaller rocks. The 307-foot section is identical to the 270-foot section of the south breakwater. Both have rock surrounding the inner and outer bases. There is then a short (111-foot) section of Z-type sheet steel filled with sand, capped with 2+ ton rock, and protected on the lakeward side by 3+ ton riprap. The breakwater terminates harborward with 190 feet of Z-type sheet steel revetment surfaced with rock on the landward side. There is a navigation light on the lakeward end of the north breakwater.

1.403 The entry channel is situated between the piers and extends a distance of 750 feet from the north pierhead through the alluvial fan into the mouth of the Traverse River. Except for the slightly flaring entry it is 50 feet wide overall and has a project depth of 12 feet.

1.404 At the west end of the entry channel, a harbor basin has been constructed in a sheltered bend of the river at right angles to the entry channel. Project length, width, and depth dimensions for the basin were 450, 200, and 10 feet, respectively. The project has since been modified by a 200-foot long, 50-foot wide channel extension upstream into the Traverse River. The authorized project and project modifications were completed in 1973. A summarization of the operational history and costs is included in table 1.

1.500 <u>Improvements By Others</u> - A boat launching ramp was constructed inside the harbor by the State of Michigan in 1972. It is presently maintained by Schoolcraft Township and Houghton County. No other construction has been undertaken by other interests within the confines of the Corps breakwaters. Many recreational craft are moored at private landings above the harbor along the Traverse River.

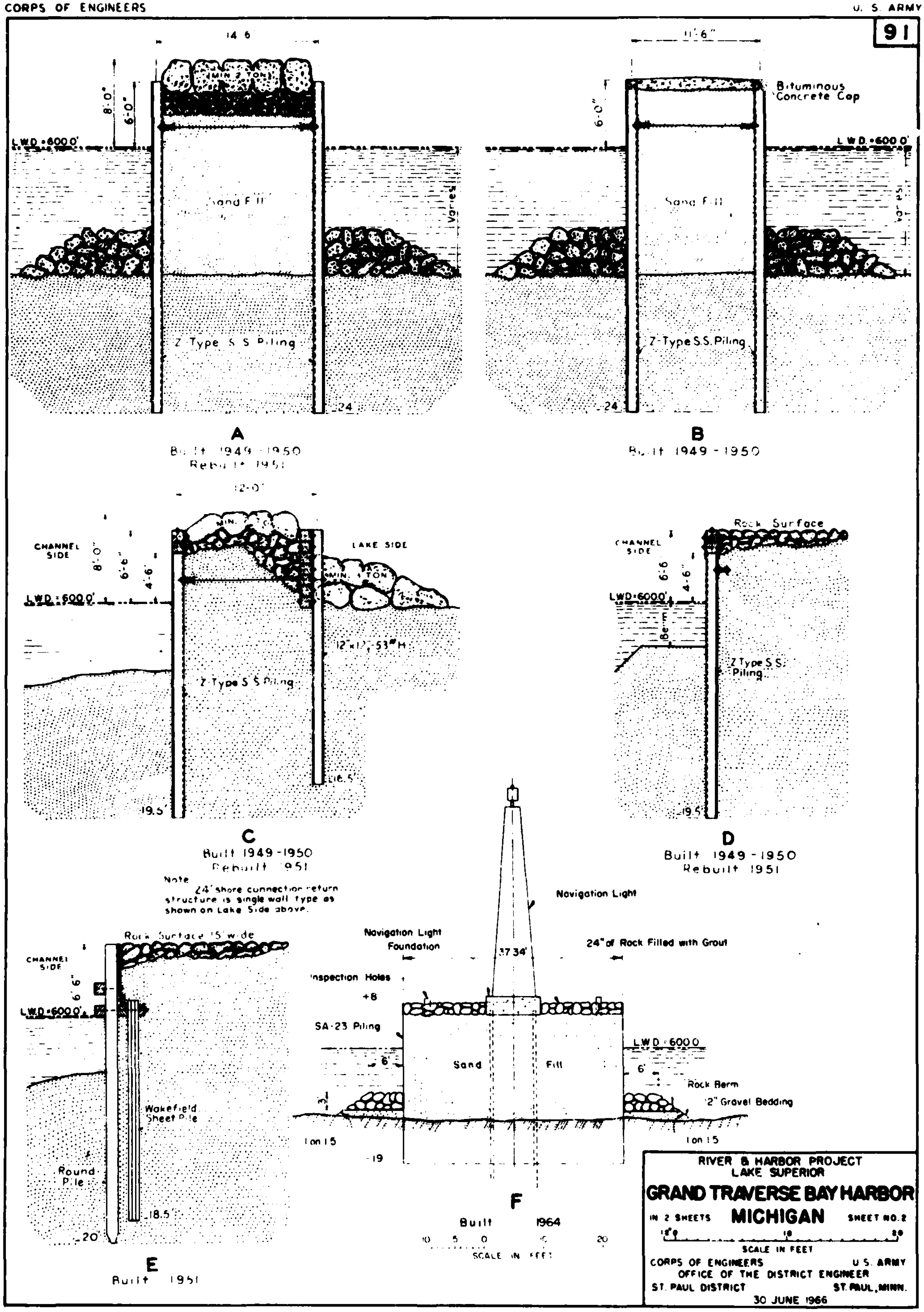

91
14.6
(MIN 2 TON)
8'-0"
6'-0"
LWD +600.0'
Sand Fill
Varies
Z-Type S.S. Piling
24
A
Built 1949-1950
Rebuilt 1951
11'-6"
Bituminous Concrete Cap
6'-0"
LWD +600.0'
Sand Fill
Z-Type S.S. Piling
24
B
Built 1949-1950
12'-0"
CHANNEL SIDE
LAKE SIDE
8'-0"
6'-6"
4'-6"
LWD +600.0'
12"x12"-53# H
Z-Type S.S. Piling
16.5
19.5
C
Built 1949-1950
Rebuilt 1951
Note
24' shore connection return structure is single wall type as shown on Lake Side above.
Rock Surface
CHANNEL SIDE
6'-6"
4'-6"
LWD +600.0'
Z Type S.S. Piling
19.5
D
Built 1949-1950
Rebuilt 1951
Rock Surface 15' wide
CHANNEL SIDE
6'-6"
LWD +600.0'
Wakefield Sheet Pile
Round Pile
18.5
20
E
Built 1951
Navigation Light
Navigation Light Foundation
24" of Rock Filled with Grout
37.34'
Inspection Holes
+8
SA-23 Piling
LWD +600.0
6'
Sand
Fill
Rock Berm
12" Gravel Bedding
1 on 1.5
-19
F
Built 1964
SCALE IN FEET
RIVER & HARBOR PROJECT
LAKE SUPERIOR
GRAND TRAVERSE BAY HARBOR
IN 2 SHEETS
MICHIGAN
SHEET NO. 2
SCALE IN FEET
CORPS OF ENGINEERS U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
ST. PAUL DISTRICT ST. PAUL, MINN.
30 JUNE 1966

FIGURE 3

TABLE 1 - Summary of Corps of Engineers Activity in Grand Traverse Bay Harbor, 1945 - 1972.

Year	Event Description	Cubic Yds. Removed	Costs $ New	$ Maint.
1945 to 1950	Construction of piers, planning	0	$ 26,795	
1950	Dredging	45,480	150,555	
1951	New work dredging	42,061	20,430	3,354
1952	Dredging, modifications to harbor structure	2,255		85,371
1953 to 1955	Condition surveys			1,836
1956	Dredge shoals	15,445		17,497
1962	Surveys, dredge shoals	8,350		15,000
1963	Surveys, extend harbor	7,625		20,244
1964	Extend N. pier, engineering			53,258
1965	Dredging, payment for pier	9,225		68,435
1966	Project area extended 200' upstream	12,625		20,064
1967- 68	Surveys, minor dredging			15,700
1969-70	Dredge to restore depths repair N. pier	27,300		33,194
1971	Survey, breakwater repair dredging	3,250		12,720
1972	Surveys, dredging steel for breakwater extension 1973	1,250		100,776
	Total cubic yards removed through 1972:	174,866		
	Total itemized costs through 1972:		$198,000	$449,259
	Total costs		$647,259	

1.600 Future Structures - At the present time there are no plans for further construction by the Corps of Engineers at Grand Traverse Bay Harbor.

1.700 Proposed Project - The proposed action is the continued operation and maintenance of Grand Traverse Bay Harbor in accordance with project authorizations and implied public needs. Operation and maintenance activities are described below.

1.800 Operation and Maintenance - The purpose of the Corps of Engineers activities and structures in the Grand Traverse Bay Harbor is to maintain the harbor entry and provide navigational safeguards. The principal operation and maintenance activities attendant to this end involve breakwater repair, dredging and dredged material disposal.

1.810 Breakwater Maintenance. Maintenance consists primarily of replacing rock torn from the Grand Traverse Bay breakwater during Lake Superior storms and is performed as needed. Breakwater repair is normally conducted by the crane barge MARKUS in conjunction with the tug DULUTH and the tender FAIRCHILD. The MARKUS can be used to transport repair equipment and supplies and can be equipped with a mechanical rock grapple for hoisting, moving, and placing 3- to 10-ton boulders at the repair site.

1.820 Dredging - Most of the recent dredging has been done by the MARKUS with the tender FAIRCHILD and the tug DULUTH. About 85,000 cubic yards were removed in construction and 89,000 cubic yards have been removed in maintenance operations. Some material has been dredged by contract equipment to be used as sand fill in breakwaters (steel sheet pile cells). Maintenance dredging has occurred almost on an annual basis and it is estimated that 3,000 cubic yards would be removed approximately annually in future years. This volume may vary considerably from year to year depending on rates of sediment deposition.

1.821 Grand Traverse Bay Harbor receives water and sediment from the Traverse River (recent studies by Michigan Technological University indicate that the sediment load is small). The harbor also receives sand from erosion of the Lake Superior shoreline which is transported by waves and currents into the harbor. The predominant direction of littoral drift is from north to south. The shoreline north of the harbor is covered with copper mine tailings transported by littoral currents and wave action from the Gay Mine tailings deposits located about 4 miles north of the harbor.

1.830 Dredge Material Disposal - The U.S. Environmental Protection Agency classified Grand Traverse Bay Harbor as unpolluted on 29 April 1971. Therefore, open-lake disposal of dredge material and beach nourishment have been utilized as disposal methods to date. This practice would continue.

1.831 There are two designated disposal sites. One is located in the open bay 1 mile south-southeast of the harbor entrance, the other is a 5.7-acre area measuring 200 x 1,000 feet along the shore 50 feet south of the south breakwater at a water depth of 6 feet. Dredged material is placed in this area as beach nourishment.

2.000 ENVIRONMENTAL SETTING

2.100 Introduction - Grand Traverse Bay Harbor is situated on the eastern shore of the Keweenaw Peninsula. It is very nearly on the Houghton-Keweenaw County line. The peninsula is unique in terms of its geology and geomorphology, climatic and vegetational characteristics.

2.200 Physical Environment.

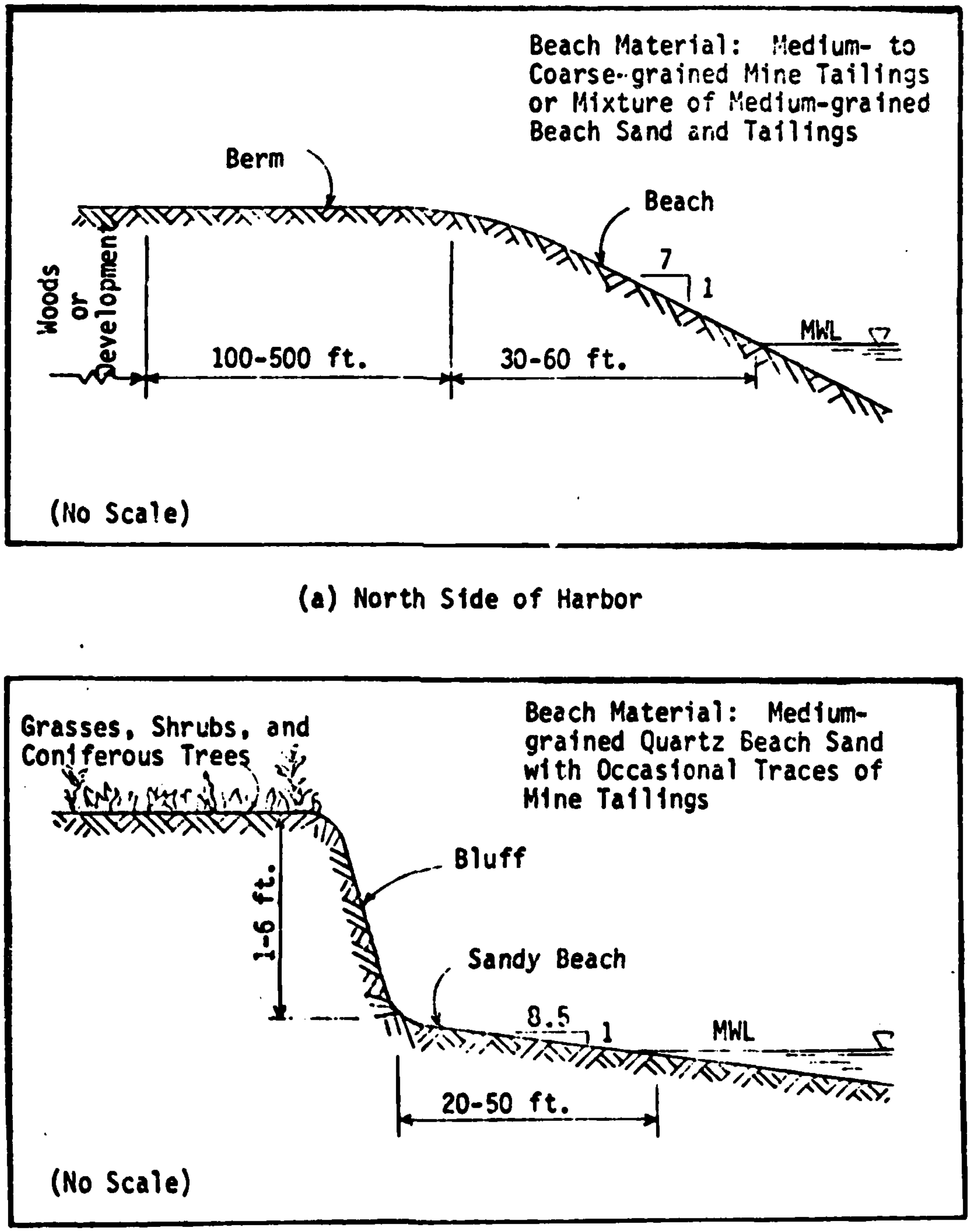
2.210 Geology, Geomorphology, and Topography - The area around Grand Traverse Bay Harbor was shaped during the Pleistocene glaciation. During this period successive ice sheets advanced and retreated across the area filling valleys, creating valleys and lakes, eroding hills, and depositing glacial till in various places.

2.211 The general topography of the area is relatively flat to about 10 miles inland on the north. Over that distance, elevation gradually increases from about 600 feet to 1,000 feet. There is then an abrupt rise to the Copper Range, the "spine of the Keweenaw", where elevations exceed 1,500 feet a short distance to the northeast. Down this spine runs a fracture in the earth's crust, the Keweenaw fault. This fault line separates the Keweenawan upland on the northwest from the sandstone lowland of the southeast. The rocks northwest of the fault were uplifted relative to the younger upper Precambrian or lower Cambrian Jacobsville Sandstones on the southeast.

2.212 The underlying rock in the Grand Traverse Bay area is Jacobsville Sandstone, a reddish brown to red fine to medium-grained sandstone with occasional interbedded shale and conglomerate. This formation outcrops in the vicinity of Gay as verticle to overhanging bluffs. At the present time these bluffs are far removed from the lake due to the very extensive deposit of copper mill tailings at Gay. The shoreline in the area is quite low and consists of easily erodible material.

2.213 The present harbor structure separates the shoreline into two distinct beaches (figure 4). On the south side of the harbor, the beach is made up of medium-grained quartz sand. The small bluff marks the beginning of the vegetation along the shoreline. The coarser material on the north side of the harbor supports a

Figure 4. - Typical Beach Profiles, Grand Traverse Bay, Michigan.



(a) North Side of Harbor

(b) South Side of Harbor

slightly steeper beach slope, as would be expected. The beach rises to a relatively level berm which extends back for some distance, depending on the extent of tailing deposition, to the woods. Just north of the harbor, the material is a mixture of the natural beach sand and the intruding mine tailings, which have just reached the harbor within the past 5 years.

2.220 Shoreline Changes - Before 1865 the area near Gay, Michigan was being eroded as evidenced by the steep sandstone cliffs to the water's edge. Further south, the abandoned beach lines confirm the fact that since the Pleistocene period Lake Superior has receded resulting in what might be classed as deposition.

2.221 The massive deposit of mine tailings at Gay has moved southward with the predominant north to south littoral currents. The mine tailings advanced to the south circumventing an old coal dock and have covered a former sand beach just north of the harbor. Using available air photo coverage it was possible to approximate the advance of the Gay mine tailings toward Traverse Harbor. From 1938 to 1974, the tailings have moved along the shore at an average rate of about 240 feet per year. The area from the harbor to 1,000 feet north has advanced 160-170 feet into the lake.

2.222 Typically, ice cover develops along the Grand Traverse Bay shoreline toward the end of December. The ice may achieve a thickness of several feet and extends several miles offshore. By the end of March, ice is dissipating and usually disappears in April. During the winter and early spring the ice is constantly moving in response to the wind and currents. Due to this, ice is pushed many feet above the normal waterline, moving beach material and causing local erosion problems by removing trees and bushes.

2.223 There is evidence of severe erosion south of the Corps project. Studies to determine the cause of this erosion and to find solutions to it are ongoing.

2.230 Soils - All of the soils in the Upper Peninsula, including those in the Grand Traverse Bay Harbor area, have developed from glacial drift and glacial lake deposits. These range from a few inches to several hundred feet in thickness. The topography is directly related to these deposits and wherever the drift is thin or absent, the topography is controlled by the bedrock. Soils are not always representative of the underlying material as drift may have been brought in from sources some distance away and subsequently deposited.

2.231 A small area immediately adjacent to the harbor is covered by soil of the Rubicon Association. It is a moderately deep and well drained soil on nearly level topography. Available water capacity

is low and permeability is high with a dominant slope range of 0 horizontal - 6 verticle. It is poor for agriculture and fair for forestry because of dryness. There is a hazard of pollution of groundwater because of the high permeability of this association.

2.232 The dominant soil type inland from the Rubicon Association consists of the Munising-Skanee-Onota Association. Depending on bedrock characteristics, the soil is deep to moderately deep, well to poorly drained, and consists of an acid loam on moderate to strongly sloping topography (dominant slope range 0-12). Natural fertility, available water capacity, and permeability are moderate with a strong frangipan (high density layer) commonly being present in the subsoil. Suitability for agriculture and forestry ranges from fair to good with the principal problems being perpetually wet areas and a lack of soil depth.

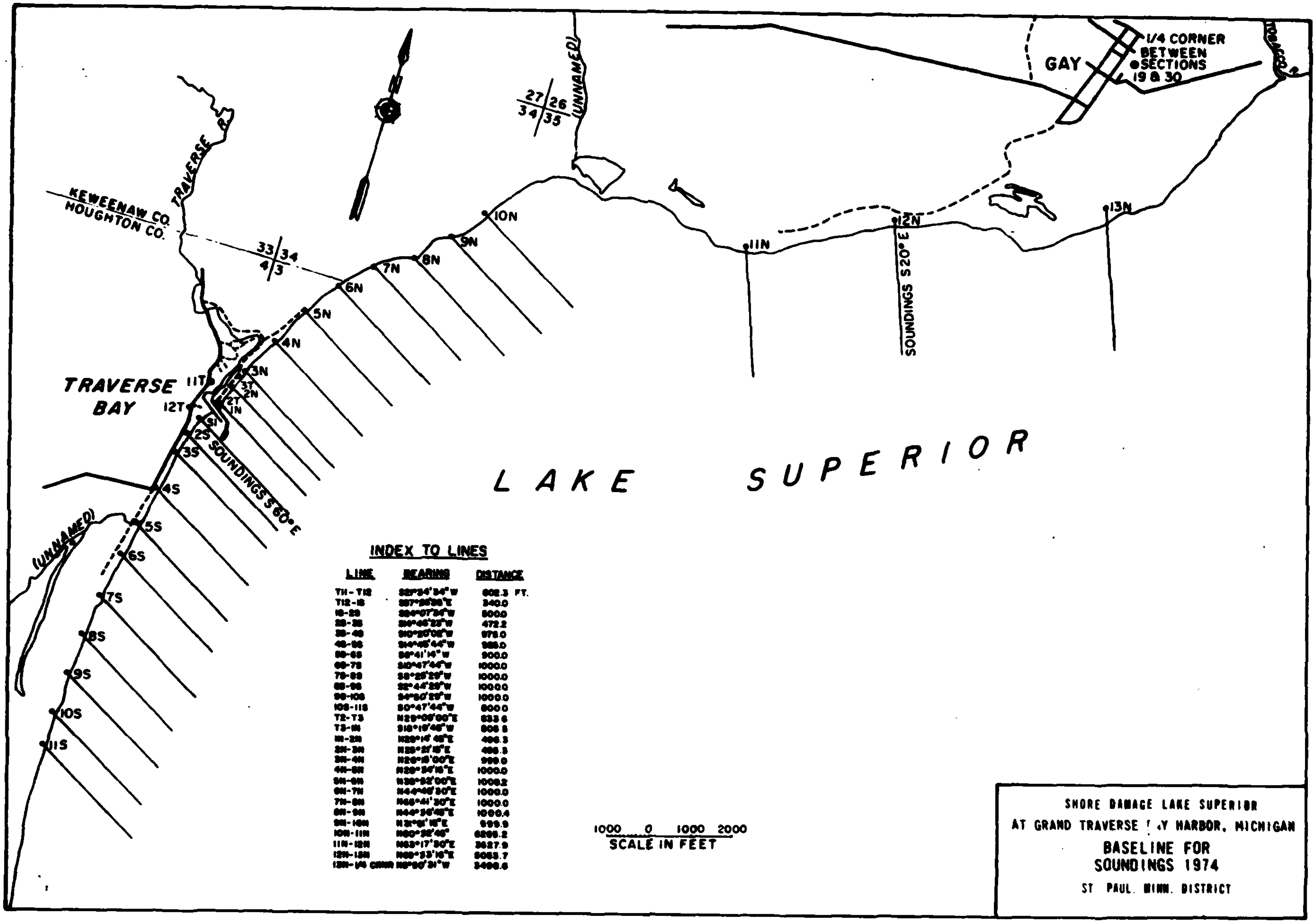
2.240 Weather and Climate - The average annual temperature at the harbor is about 40 degrees; average January and July temperatures are approximately 15 and 65 degrees, respectively. Precipitation occurs throughout the year and averages about 32 inches (1931-1961). Precipitation on the peninsula is of low intensity with few hard rainstorms, but of more frequent occurrence. Precipitation occurs on the average of 20 more days per year on the peninsula than on inland areas nearby.

2.241 The combination of cool summer temperatures and the proximity of the Lake Superior water mass result in an average relative humidity of 70 to 80 percent despite the moderate rainfall. Some of the high humidity results from inversion fogs that occur on or near the lake most of the year. The summer fogs occur as warm moist air comes in contact with the cooler lake surface.

2.242 The prevailing winds are westerly, with an average velocity of 9 miles per hour. However, wind velocity exceeds 30 miles per hour an average of 30 days out of each summer's five-month (May to September) small craft boating season. Storms accompanied by high winds blow up quickly, particularly in the spring and fall.

2.300 Hydrologic Environment.

2.310 Surface Water - Four streams enter Lake Superior within the area surrounding the Corps project. They are: 1) the Tobacco River at the extreme northerly end of the Gay tailings; 2) a small unnamed creek 1 1/2 miles north of the project; 3) the Traverse River whose mouth is within the harbor; and 4) a small unnamed creek approximately 3,000 yards south of the harbor (figure 5).



INDEX TO LINES

LINE	BEARING	DISTANCE
T11-T12	S27°24'34"W	602.3 FT.
T12-1S	S57°26'26"E	340.0
1S-2S	S24°07'34"W	500.0
2S-3S	S16°46'23"W	472.2
3S-4S	S10°20'08"W	975.0
4S-5S	S14°45'44"W	985.0
5S-6S	S6°41'14"W	900.0
6S-7S	S10°47'44"W	1000.0
7S-8S	S8°25'29"W	1000.0
8S-9S	S2°44'29"W	1000.0
9S-10S	S4°50'29"W	1000.0
10S-11S	S0°47'44"W	800.0
T2-T3	N29°08'00"E	833.6
T3-1N	S18°19'48"W	806.8
1N-2N	N29°14'48"E	496.3
2N-3N	N25°21'15"E	496.3
3N-4N	N26°18'00"E	999.0
4N-5N	N29°34'16"E	1000.0
5N-6N	N38°32'00"E	1008.2
6N-7N	N44°48'30"E	1000.0
7N-8N	N65°41'30"E	1000.0
8N-9N	N44°36'45"E	1000.4
9N-10N	N31°51'16"E	999.9
10N-11N	N80°32'45"	6266.2
11N-12N	N83°17'30"E	3627.9
12N-13N	N89°53'16"E	5053.7
13N-1/4 CRNR	N5°50'31"W	3496.6

FIGURE 5

2.320 Groundwater - Keweenaw and Houghton Counties do not have abundant supplies of groundwater. The recorded wells at Grand Traverse Bay Harbor indicate that water for domestic water supplies is obtained from wells drilled in glacial drift or Jacobsville Sandstone. Many summer cottages along the shores of Lake Superior obtain water by laying small diameter drive points on the lake bottom.

2.321 Most of the wells in glacial drift obtain water from morainal deposits. Yields of wells in morainal areas generally are great enough to supply a power pump. The majority of wells yield enough water for a modern domestic water supply. The water quality is generally satisfactory, but a few wells yield water with troublesome amounts of iron.

2.322 The Jacobsville Sandstone yields small to moderate supplies of fresh water to most wells. Almost all bedrock wells in the two counties yielding more than 20 gallons per minute are in Jacobsville Sandstone. The bedrock wells at Grand Traverse Bay yield less than 10 gallons per minute. Water is generally of satisfactory quality, although a few of the deeper wells may yield water too salty for domestic use. Most of the wells are in the range of 100 to 250 feet deep, but a few are shallower than 50 feet.

2.330 Lake Water Quality - The eutrophication process in Lake Superior is apparently progressing at an extremely slow rate as dictated by nature. Therefore, the measured changes in water quality are misleading when viewed from the eutrophication standpoint alone. The effect of the activity of man on Lake Superior can be more readily seen in the examination of other chemical and physical parameters.

2.331 The introduction of halogenated and chlorinated hydrocarbons are recent and a function of the activities of man. At present there is virtually no information on the levels of these compounds in Lake Superior. Measurement of these parameters is important because of the deleterious effects of the parent or breakdown products. The presence of heavy metals, taconite tailing dumping, and asbestos-like materials are acknowledged although their effects are still undetermined.

2.332 Lake Superior, the dominating body of surface water in the area, is characterized by soft water. Hardness is approximately 44 ppm $CaCo_3$. The pH is approximately 7.5. Water temperatures in Lake Superior fluctuate slightly, ranging in the 40's most of the year.

2.333 Shipping has been responsible for some water quality degradation in the open waters and harbor areas of Lake Superior. Oil discharges, bilge wastes and garbage from commercial vessels plying the lake have created occasional problems. However, enforcement programs have become more stringent in recent years, and the problem is not considered acute.

2.334 The water quality generalizations made for the open lake are appropriate for most of the inshore waters. The widespread indications of change and deterioration observable in the inshore waters of the other Great Lakes are, for the most part, not apparent in Lake Superior.

2.340 Harbor Water Quality - Grand Traverse Bay can be described as a "river harbor". That is, the harbor is located at a river mouth, which receives and collects sediment loads carried by the river.

2.341 Grand Traverse Bay Harbor receives the water and sediment from the Traverse River. The harbor also receives sand from erosion by Lake Superior that is transported by waves and currents into the harbor. The river not only carries sediments and deposits them in deeper areas of the harbor, but also acts as a mixing agent for sediment that has already been deposited on the bottom. This movement of sediments results in increased contact between the silt and clay sized particles and the chemicals (organic and heavy metal) present in the water causing an accumulation of these chemicals in the bottom sediments. In order to permit comparison between and within specific areas of the harbor, the harbor was arbitrarily subdivided into four zones (exhibit 1).

2.342 In addition to the overall influence of the rivers and Lake Superior in Grand Traverse Bay Harbor, each zone has specific factors which influence the sediments within that zone. Zone IV is the entry to the harbor. The major factor which influences this zone is the wave action from Lake Superior. Boats travel in this zone and may contribute material as well as disturb the sediments.

2.343 Zone II is the channel into the harbor contained between the breakwaters. Sand moved by wave action scours the surfaces of the breakwaters in this area and abrades away metals that can mix with the sediments.

2.344 Zone I is a basin lined by private docks, homes and cabins. A public boat ramp is located in this zone and numerous boats are moored on the edge of the channel.

2.345 Zone III is located at the head of the harbor and includes a portion of the undredged riverbed. The river channel is lined by homes and cabins. This area is also used for the mooring of pleasure crafts.

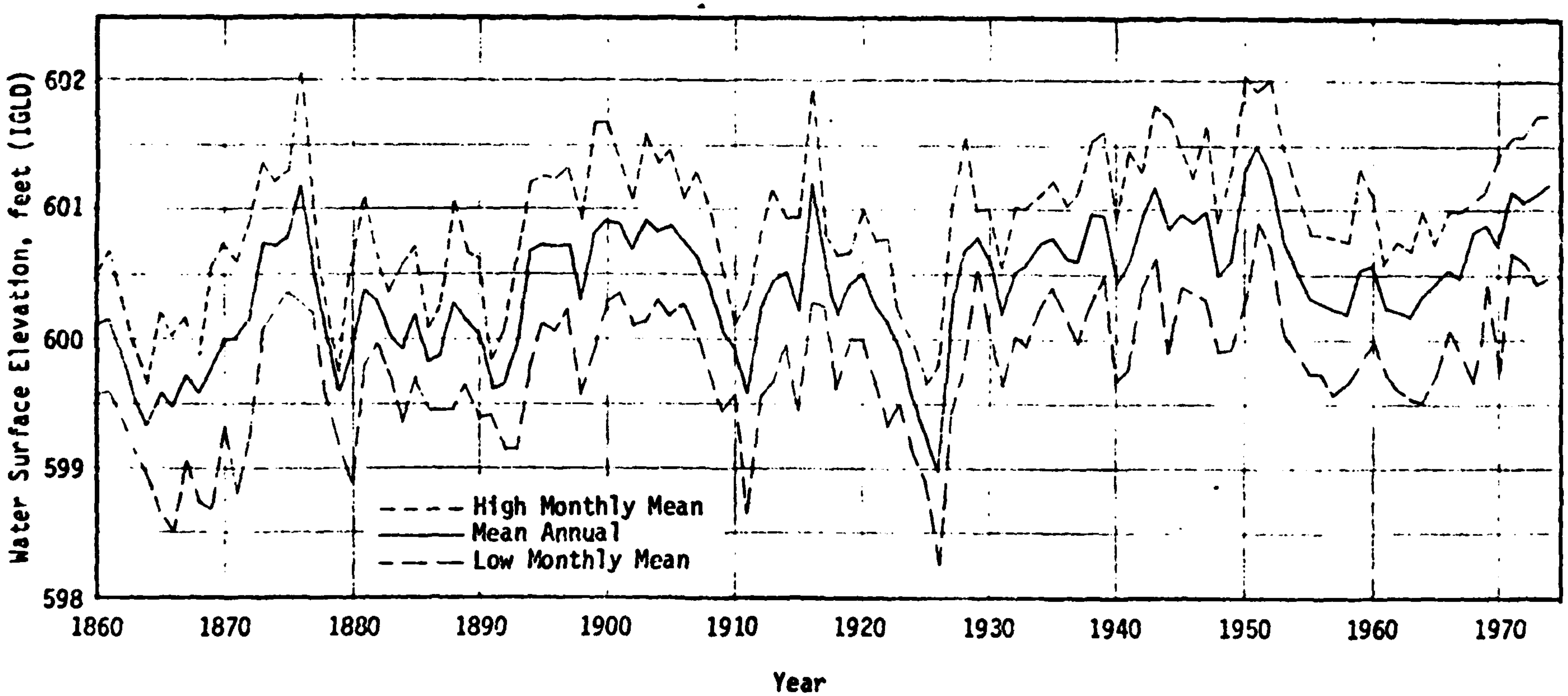
2.346 The U.S. Environmental Protection Agency (EPA), Michigan Technological University (MTU), and National Biocentric, Inc. (NBI) have all sampled Grand Traverse Bay Harbor for chemical constituents (exhibit 2). It was the conclusion of EPA that the harbor is unpolluted. However, limited data from the EPA and NBI indicate that zinc and organic matter are present in appreciable quantities in the upper harbor. In the event the harbor was reclassified as polluted, an on-land disposal site would be obtained.

2.347 Grand Traverse Bay Harbor was sampled for coliform bacteria by MTU in the summer of 1973 (exhibit 3). Although there were four zones for analytic purposes, only three were sampled. In Zone III, the zone upstream, total and fecal coliforms were high as compared with other harbors in the area. In Zone I, the next zone downstream, they were very high, but decreased downstream in Zone II to values approximating those observed in Zone III upstream. As one progresses downstream in this harbor from the uppermost station in Zone III to the lowermost in Zone II, passage is between a number of houses on the riverbank and boats in the river. The total and fecal coliform distribution appears explainable in terms of septic tanks and direct sewage effluent into the harbor. In general, the land and soils around the harbor are not suitable for septic tanks. The coliform decrease in Zone II, near the harbor mouth, is brought about by dieoff and dilution.

2.350 <u>Lake Superior Water Levels</u> - The effect of water level on the stability of a beach is very significant since a rise in water level brings damaging wave activity closer to backshore and bluff areas. In addition, with a mild beach slope, a small rise in water level can produce noticeable apparent loss of beach, which is often the cause of concern by local residents.

2.351 The level of Lake Superior from 1860 through 1974 is shown in figure 6. By comparing the high and low monthly plots, it can be seen that the mean monthly level has varied by more than 3 1/2 feet. Following the low levels of 1926, Lake Superior has maintained a relatively high level to the present.

FIGURE 6 - Lake Superior Water Levels, 1860 - 1974, at Marquette, Michigan.



2.400 Biological Environment.

2.410 General - The vegetation of the Grand Traverse Bay Harbor area can best be described as a mosaic of the forest communities of the northern Great Lakes region. The extension of the Keweenaw Peninsula into Lake Superior results in a situation in which the natural environmental influences are more delicately balanced than in mainland areas. Soil type, climate, slope angle, and slope orientation have combined to form differing natural habitats necessary to support the variety of vegetation found on the Upper Peninsula.

2.420 Terrestrial Vegetation - Inland from the harbor, on the better drained land, are primarily northern hardwoods of the sugar maple, elm, yellow birch, and hemlock variety. Aspen, fir, spruce, and white pine are also present.

2.421 The shores of Lake Superior are surrounded by recessional beach lines from another era. In the harbor area, the tops of the beach lines (ridges), if adequately drained, are populated by red, white, and jack pine. In the valleys between the beach lines, cedar and aspen are the predominant species of trees. In the very low and poorly drained areas are found willows and alder. The trees bordering the tailing area include alders, willows, and spruce. There is a lowland bog south and inland from the harbor; it is vegetated by low-brush cranberrys, perrenial grasses, spruce, poplars, balsam, and cedars.

2.430 Fish and Wildlife - There is both a sport and commercial fishery at the harbor. Herring and chubs are the primary commercial catch. Lake trout and other salmonids are caught by sport fishermen in the harbor mouth and along the breakwaters as well as offshore on the reefs. The Traverse River is frequented by brook, brown, and rainbow trout. There is a spring spawning run of steelhead (rainbow) trout in the Traverse and Tobacco Rivers. Just to the southwest of Grand Traverse Bay is Rice Lake. It is a shallow lake with abundant shoreline vegetation, and supports a population of pike, perch, and bass. Black ducks, woodducks, geese and other waterfowl frequent its extensive wetlands.

2.431 The adjacent forest lands surrounding the harbor provide habitat for a diversity of songbirds, birds of prey, and upland gamebirds. Whitetail deer, black bear, coyotes, foxes, skunks, porcupines, red squirrels, ruffed grouse, woodcock, and snowshoe hare are the more common species of wildlife found in the area.

2.440 Plankton - Plankton collections were conducted by MTU in June and August 1973. In both months there was a progression of phytoplankters as one moves down the river and into the harbor mouth. Asterionella was the dominant phytoplankton in June, with numbers ranging from 2,000 to 8,000 cells per liter. Zooplankton consisted of 400-500 Trachelmonas in one of six samples. In August there was no clear dominance in any of six samples. Zooplankton of the genera Kellicottia, Cyclops, and Daphnia were observed in a few of the samples. During both sampling periods Oscillatoria, Gomphonema, Arthrospira, Stigeoclonium, and other species commonly associated with polluted or enriched waters were present. This probably results from sewage that is presumed to be entering the harbor.

2.450 Aquatic Macrophytes - No aquatic macrophytes were observed in the project area or adjacent parts of the harbor.

2.460 Benthic Organisms - Sampling for benthic organisms was done by NBI and MTU (exhibits 4 and 5). Grand Traverse Bay Harbor was unusual in that the dredged area had a much greater density of benthic animals than the undredged areas. However, a comparison is probably not justified because the undredged areas differed with the dredged areas in many other factors in addition to dredging activity. The Traverse River undredged area had little fine sediment and flowing water while the Lake Superior area was subject to considerable wave action. Without suitable control areas it is difficult to assess the effect of dredging. In other Michigan harbors where dredged and undredged areas were more comparable, the dredged areas almost always supported fewer animals.

2.470 Threatened and Endangered Species - Although there may be some threatened and endangered species in the harbor or project area, a check with the Michigan Department of Natural Resources and the U.S. Fish and Wildlife Service has failed to disclose the existence of such species in the harbor area.

2.500 Socioeconomic Environment.

2.510 Historic and Archaeological Resources - The most recent listing of the National Register of Historic Places, dated February 1975 and updated o May 1975, has been consulted and no National Register property is affected by the project.

2.511 Coordination has been initiated with the National Park Service, the Michigan State Archaeologist and the Michigan Historic Preservation Officer to insure compliance with section 6 of the National Historic Preservation Act of 1966 in accordance with procedures of the Advisory Council on Historic Preservation Executive Order 11593, Protection and Enhancement of the Cultural Environment. Coordination and responses received to date are included as exhibits 6, 7, and 8.

2.512 Information from the Michigan State Archaeologist indicates that no archaeologic sites, recorded or unrecorded, would be affected by operation and maintenance activities as proposed. Although unlikely, if a site were discovered as a result of Corps activity, work would be halted and an archaeologist would survey the site for further determination.

2.513 A recent study of the area has identified a historic site, the Grand Traverse Fishing Community. The effect of operation and maintenance activities, if any, on this historic site will be addressed following further coordination (exhibit 9), and clarification of its location relative to the Corps of Engineers project. It is not anticipated, however, that any on-land historic site would be affected by Corps activities.

2.520 Historic Background - The development of mines to exploit the native copper deposits of the Keweenaw Peninsula led to the construction of many stamp mills. Convenience and economics, not environmental concern, dictated the location of these mills. The mechanical separation of copper from the native rock resulted in vast quantities of tailings to be disposed of. In most circumstances disposal was into the Keweenaw Waterway or Lake Superior on either side of the peninsula. Two stamp mills existed side by side at Gay, Michigan. The Mohawk Mill went into production on 9 August 1902 and the Wolverine Mill started stamping on 4 December 1902.

2.521 There was a coal dock constructed between harbor Rays 10-N and 11-N (figure 4, page 11) in conjunction with the mining operations. Records indicate that the dock was constructed in 1902, was 30 feet wide and 300 feet long, and would accomodate a boat with a 14-foot draft. Present field evidence shows, from the original shore, a 400-foot long embankment, a widened fill about 300 feet long probably for coal storage, and a trestle about 285 feet long. It appears the entire structure was filled to at least lake level, thus acting as a barrier or groin. The coal dock was used little, if at all, after 1932 and according to a local resident the structure slowly deteriorated due to the elements and informal salvage operations conducted by local people.

2.522 By 1905 a commercial fishing settlement had developed at Grand Traverse Bay Harbor. The river entrance had been cut through the beach at approximately the present location. A retaining structure was present along the north bank of the river extending to the lake.

2.523 North of Grand Traverse Bay Harbor, at the stamp mills, it became necessary in 1910 to elevate the tailings by conveyor belt to dispose of them. This was due to the filling of the bay at Gay by the production of the tailings. The Wolverine Mill was closed 1 April 1925 and the Mohawk Mill ceased operations in 1932. While in operation, the two mines deposited approximately 12,785,000 cubic yards of tailings into Gay Bay.

2.524 By 1940 there were a considerable number of dwellings in the vicinity of the river mouth. The river mouth protection had been improved. Parallel log cribs extended into the lake 60 feet beyond the beach on the north and 120 feet on the south side of the river. By this time permanent horizontal and verticle control had been placed in the area by the Corps of Engineers.

2.525 In 1949 a considerable harbor improvement project was undertaken. Just before this construction, the parallel log cribs extended 50 feet into the lake on the north and 125 on the south side of the river. The 1949-1950 construction included the lower portion of the Traverse River, enlarging a section of the river, changing a portion of the river, and changing river-mouth structures. The log cribs with a 20-foot clear width were abandoned and replaced by a new pair of parallel double wall sheetpile breakwaters with a clear width of 125 feet. The new centerline was 18° counterclockwise from the centerline of the old timber cribs and more nearly perpendicular to the shoreline to the north. Supplementary structures including a short angled extension of the new north breakwater were added and work was completed in 1951.

2.526 In 1964, a line of 4 connected circular sheetpile cells was added to the end of the north breakwater. During 1972-73, 3 additional circular sheetpile cells were added to the north breakwater at an angle of 26 1/2° clockwise from the existing centerline.

2.530 Social Characteristics - The community at the harbor has about 30 residents on an annual basis. Children attend school in Lake Linden. There are no schools, stores, motels, restaurants, or other amenities in Grand Traverse Bay. Power is provided by the Ontonagon REA and telephone by Michigan Bell Telephone Company. There is no water or sewer system. Schoolcraft Township (in which the harbor is located) had a population of 2,145 in 1960 and 1,939 in 1970, a decrease of 9.6 percent. There is 12 percent unemployment in the township.

2.531 The closest economic ties of the area are with Houghton-Hancock, Calumet-Laurium, and Lake Linden. Because of its small size the impact of the harbor on each of the associated communities is probably negligible.

2.540 Transportation - Access to Grand Traverse Bay Harbor is by county road from Gay or Lake Linden. There are no railroads, buslines, airports, hospitals, or businesses.

2.600 Future Environmental Setting Without the Project - Without a maintained project, storm generated waves would eventually destroy the breakwater structures. The breakwaters provide safe access to the Traverse River during periods of inclement weather. Although these processes resulting from no maintenance would be slow to occur, eventually the loss of the breakwater and entry shoaling would close the harbor to most watercraft.

2.601 The absence of the breakwater would eventually put one commercial fisherman out of business. Sport fishermen who use the launching ramp just inside the breakwater would be denied this access point to Lake Superior, and it would eliminate a small craft harbor-of-refuge along Michigan's Upper Peninsula.

2.602 It is hypothesized that were the harbor works not present, natural accretion covered by coarse gray tailings would exist for some distance south of the existing harbor.

3.000 RELATIONSHIP OF THE HARBOR TO FUTURE LAND USE

3.001 There are no commercial facilities available at the harbor. The buildings in the harbor area are largely summer residences. There are no apparent opportunities for commercial development in Grand Traverse Bay Harbor and the surrounding area as a whole is experiencing a decline in population.

3.100 Harbor-Related Activity - The harbor is used primarily by a commercial fisherman and recreational craft. Most of the recreational use is by those with small, easily trailered boats, usually using the launching ramp for 1-day excursions offshore. As of 1973, there were an estimated 25 or 30 vessels moored at private landings above the harbor.

3.101 Commercial fishing at Grand Traverse Bay Harbor is not expected to increase. Commercial fishing in Michigan waters of Lake Superior is also decreasing. The invasion of the sea lamprey and overfishing virtually destroyed the lake trout fishery in the early 1960's. Lamprey control measures, combined with massive efforts at stocking trout and salmon, have only lately succeeded in bringing the fishery back to a productive level. In 1961, 1,100 tons of fish were caught by Grand Traverse fishermen. In 1971, only 200 tons were taken.

4.000 PROBABLE IMPACT OF OPERATION AND MAINTENANCE ACTIVITIES ON THE ENVIRONMENT

4.100 General - Maintenance activities in Grand Traverse Bay Harbor are conducted as required. Certain amounts of petroleum products may reach the water directly as a result of equipment submersion. Reasonable care is maintained to prevent oil and grease from entering the water; however, temporary oil slicks may occur in the vicinity of operating equipment. Short-term impacts to air quality may result as diesel exhaust from the motors aboard the MARKUS, tug and tenders must be vented into the open air.

4.200 Socioeconomic Impacts - The primary economic justification for developing and maintaining the harbor has been the need for a harbor-of-refuge for recreation and fishing. Prior to deepening and widening the harbor, the nearest refuge point to the west was the Keweenaw Waterway. To the east, refuge was available at Lac La Belle. It is impossible to estimate accurately the dollar value of losses prevented by the breakwaters, but the existence of the breakwaters is essential to the harbor-of-refuge concept.

4.210 Recreational Value - Sport fishermen fish from the breakwaters at the entrance to the harbor. The north breakwater is particularly popular as it is the longer of the two. In spring and fall many fishermen may be seen on the breakwater. The primary catch is lake trout, although other species are taken as well. The expected resurgence of the lake trout would further enhance the recreational value of the breakwaters.

4.300 Impacts of Breakwater Maintenance.

4.310 Noise - A certain amount of noise is associated with the operation of the various motors, pistons, winches, etc. Little of the noise associated with the equipment is audible beyond a hundred yard distance and increased noise levels during maintenance operations would not have a significant adverse impact.

4.320 Activity-Related Congestion - While at the repair site, equipment is tied up to the breakwater out of navigation channels and would not contribute to harbor congestion.

4.330 Biological - Breakwaters along a relatively unsheltered coastline provide an area of calm water for navigational purposes, and also provide a relatively calm and sheltered habitat for species which would normally not be found in this area. Increases in macrophytes, plankton and benthic species can be expected in areas of reduced wave force. As the habitat and nutrient levels increase, increases could also occur in kinds and numbers of fish present.

4.340 Chemical - Breakwaters may contribute trace amounts of various chemicals as a result of leaching of native rock or concrete after long submersion in the water, as well as zinc and small amounts of lead, cadmium and iron. Painted or electrified navigational aids on breakwaters may contribute lead, zinc, copper and other elements as they age and/or deteriorate under constant exposure to weathering. In this case no long-term adverse effects are expected.

4.400 Impacts of Dredging.

4.410 Turbidity - Dredging creates a certain amount of turbidity (muddied or sediment clouded water). Lifting a load of sediments out of the water also causes turbidity as "mud" washes out of the dredge bucket.

4.411 Dredging redistributes and resuspends the finer sediment material found at the sediment-water interface. This fine material settles out and redeposits in dredged and adjacent undredged areas after dredging has ceased. The layer of fine, easily disturbed sediments may, therefore, be greater in the adjacent undredged areas representing the original state plus some of the material stirred up by dredging.

4.412 The amount of turbidity is related in part to the nature of the bottom sediments being dredged. Sand and gravel create relatively little turbidity, while clay and light organic "muck" will create more turbidity. Generally, however, the "plume" of dredge-induced turbidity is of relatively small extent and of short duration.

4.413 Turbidity affects the amount of light penetrating into the water. Reduction in light penetration of relatively short duration will have little effect upon the light requirements of sensitive organisms.

4.414 More subtle and, therefore, more difficult to accurately determine effects are those produced upon water quality in the area of the operating equipment. Turbidity clouds and associated release of oxygen consuming nutrients, especially where dredging of organic sediments is being conducted, can be expected to reduce the dissolved oxygen level of the surrounding water, driving off fish. Those same nutrient releases, however, may over a period of time, result in higher plankton levels, an influx of rough fish and a higher biomass and perhaps greater species diversity for that part of the harbor being dredged.

4.415 Turbidity directly affects resuspension and redistribution and indirectly affects oxidation or reduction of various chemicals. Many of these substances are toxic to life forms, although it is as yet not fully known to what extent turbidity caused by dredging influences toxicity concentrations.

4.420 Water Contaminations - All of the operating equipment associated with the MARKUS is equipped with sanitary holding tanks for containment of on-board generated wastes. A certain amount of temporary water quality impairment exists as a result of dredging induced turbidity, discussed above.

4.421 A floating oil boom is kept at Fountain City Boat Yard, Fountain City, Wisconsin. It is packaged and ready to be shipped by automobile to any Lake Superior or Mississippi River site in the event of an accidental oil spill.

4.430 Noise - Noise associated with the operating of the dredge is substantial. The use of this equipment engenders considerable mechanical noise associated with the raising and lowering of the dredge. This noise impact is temporary, being associated only with the act of dredging during the hours of operation.

4.440 Activity Related Congestion - The act of dredging results in the location of the dredge, scow, barges and other large pieces of equipment directly in the entry or channel. As such, it presents a navigational obstacle by the mere presence of large stationary vessels. In a small harbor, this localized center of equipment causes temporary congestion problems.

4.500 Probable Impacts of Open Lake Disposal.

4.510 Turbidity - Dredged sediments are placed by the dredge into bottom dump scows which are moved by tug boat to the disposal site where they are dumped. A small amount of fine material leaks from the barge as it is being moved to the disposal site, causing a turbidity wake. A large amount of turbidity is created at the disposal site as the barge bottom dump doors are opened releasing the load of sediments to the open water. Past practice has been to dump while moving over the dump zone, resulting a turbidity plume or wake behind the moving equipment. In addition, the amount of turbidity caused during disposal is related to the nature of the sediments.

4.520 Currents and Sediment Movements - Past practice has been to dispose of dredged sediments in an open lake zone about 1 mile in diameter, 50 feet or more in depth, and away from navigation channels, public beaches, and similar areas. The practice of dumping while moving tends to maximize the exposure of dumped sediments to the influence of open lake and long shore current transport with resultant redistribution and resedimentation over a wide area.

4.530 Activity-Related Contamination - Short-term impairment of air and water quality and operation generated noise are similar to those occuring during dredging operations.

4.540 Chemical Impacts - Disposal at a 50-foot or so depth results in a possible source of heavy metals to the bulk water and bottom environment, as well as possible pH and oxygen demand changes at the bottom. Similar temporary changes would occur in the vicinity of the turbidity plume associated with dumping.

4.550 Biological Impacts - Open lake disposal is a potential danger to fish spawning beds. The covering of spawning areas with sediment materials could eventually result in a reduction of the fish population in the area. Lake trout, whitefish, and lake herring spawn on the offshore reefs in Grand Traverse Bay. The effects on fish spawning beds is minimized by dispersing the dump scow load over a wide area and not dumping on known spawning beds. Dredging operations normally take place during the summer months when fish are not spawning. Open lake disposal at Grand Traverse Harbor has not taken place over any known spawning sites.

4.600 <u>Probable Impacts of Beach Nourishment</u>.

4.610 <u>Turbidity</u> - A relatively small amount of turbidity is created at the disposal site since the barge is grounded before the bottom dump doors are opened, releasing the load of sediments into shallow water. The resultant turbidity tends to be confined to the dump area and is of short duration.

4.620 <u>Wave and Current Sediment Redistribution</u> - The purpose of beach nourishment is to replace beach sand which has been removed by storm waves or long shore currents; therefore, wave and long shore current redistribution and resedimentation of the deposited sand is desirable.

4.630 <u>Chemical</u> - Since this method gives maximum contact of the dredge material with air and water, it is expected that aerobic chemical and biological processes in the dredged material would be stimulated and dissolution rates of absorbed toxins increased. This latter is probably the most important chemical impact of this method of disposal. Rate of addition to the water of nutrients and suspended organic matter from the dredge material would be expected to be at its maximum in this type of disposal.

4.700 <u>Shoreline Erosion and Accretion</u> - There are indications that the north breakwater in Grand Traverse Bay Harbor is acting as a groin and interrupting the predominant north to south littoral drift and thereby affecting the erosion and accretion rates of the beach around the harbor. Studies of this situation have therefore been implemented and if it is found that Corps of Engineers structures are affecting these rates of deposition, action will be taken commensurate with the degree of their effect.

4.710 <u>Future Conditions</u> - Assuming that no further man-made changes occur north of the harbor, the mine tailings will continue to extend the shoreline lakeward for some time to come. The huge artificial nourishment source (the Gay mill tailings deposit) to the north may be sufficient to cause the north side of the breakwater to eventually fill with tailings and to be bypassed as occurred at the coal dock some 45 years ago. Fine particles of tailings have been noted on the beach south of the breakwaters.

4.711 South of the breakwater, the shoreline erosion may accelerate in the area near and south of Ray 4-S (figure ~~4~~ 5). The offshore removal has been considerable (erosion of older nourishments from the Traverse River before the earliest breakwater). This process should move shoreward and in the future the shoreline erosion may increase. The 1964 breakwater extension may have increased the erosion rate of the shoreline south of the breakwater.

4.712 The owners of some lakeshore homes have had to move their buildings back from the shoreline. If the erosion continues at what appears to be an increasing rate, the road will be in danger.

4.800 Socioeconomic Impacts Related to Operation and Maintenance - The major socioeconomic impact of the Corps activities in Grand Traverse Bay Harbor is that continued operation and maintenance would enable recreational craft and commercial fishing vessels to use the harbor. The degree of tourism and recreation at the harbor is relatively light, and there are no commercial establishments which cater to tourists. The economic impact of the harbor and its related activities upon the surrounding communities is negligible.

4.900 Impacts on Rare and Endangered Species - No rare and endangered species would be affected by continued operation and maintenance activities.

4.1000 Historic and Archaeological Impacts - No known historic or archeological sites are expected to be affected by continued operation and maintenance activities. The proposed undertaking would not affect federally or non-federally owned districts, structures, or objects of historical, archaeological, architectural, or cultural significance. See paragraph 2.500 for further detail.

5.000 PROBABLE UNAVOIDABLE ADVERSE EFFECTS

5.100 Dredging - Dredging the harbor bottom causes several unavoidable effects, the most obvious of which is temporary turbidity. For example, clouds of sediment are released to the water every time the dredge bucket or clamshell digs into, disturbs and removes a portion of the bottom sediments. Turbidity also results from overflowing and leaking dredge buckets, clamshells, and dump scows. Additional turbidity results when equipment and scows are cleaned by flushing sand, mud, silt and organic material off decks and operating equipment with high-pressure water hoses.

5.101 Although the full effects of turbidity are unknown in each instance it occurs, generic effects of turbidity are known, and, depending upon the duration and extent of the turbidity produced, the effects may vary considerably. Reduction of light penetration into the water is of relatively short duration and could be presumed to have no long-term effect upon the ecosystem.

5.102 More subtle and hence more difficult to assess are the effects of the operating equipment on aquatic life and water quality in the area being dredged. Turbidity clouds and the associated release of oxygen consuming nutrients, especially where organic sediments are being dredged, can be expected to reduce the dissolved oxygen level of the surrounding water. Those same releases may result in higher plankton levels and in increased biomass, and perhaps greater species diversity. Ultimately, it may be expected that the area would return to an ecological equilibrium if no further dredging occurred.

5.103 Aside from turbidity influenced effects, the physical act of digging and disrupting the habitat of various benthic dwelling organisms must be considered an unavoidable effect of the dredging operation. Adult fish are mobile and are able to swim out of the way of the dredge scoop or clamshell. Benthic dwelling organisms such as bacteria, fungi, worms, molluscs, insect larvae, fish larvae, and crustacea must be considered relatively immobile and are therefore subject to being dredged up along with their habitat.

5.200 Disposal.

5.210 Open Lake Disposal - Open lake disposal of material dredged from the Grand Traverse Bay Harbor was practiced through 1973. Certain characteristics of open water or open lake disposal are similar to those of turbidity, resuspension, redistribution and solubility problems and effects previously discussed under dredging impacts. An additional unavoidable effect of the open lake disposal of dredged sediments is the burying, en masse, of benthic dwelling organisms under the unloaded or bottom dumped sediments. In cases of off-shore disposal, the nutrients released to the water may spur an increase of plankton growth.

6.000 ALTERNATIVES

6.100 No Project Alternative - If the Corps of Engineers discontinued maintenance of this project, harbor entry shoaling and breakwater disrepair would eventually render the harbor entry non-navigable. The commercial fisherman using the harbor as a port would have to fish elsewhere or go out of business. People using the harbor for recreational boating or sport fishing would have to find another place to pursue these activities. The direct economic impacts of the harbor are negligible. The greatest impact would be the loss of an important small craft harbor-of-refuge along Michigan's Lake Superior shoreline.

6.200 Disposal Alternative.

6.210 On-land Disposal - As stated in section 1, open-lake disposal and beach nourishment are the proposed methods of dredge material disposal. On-land disposal (unconfined or confined) is an additional method and is usually practiced when the dredged material is classified polluted. Grand Traverse Bay Harbor sediments are presently classified unpolluted, therefore, on-land disposal has not been considered due to increased costs of this alternative and because of the availability of other environmentally acceptable disposal methods.

7.000 RELATIONSHIP BETWEEN SHORT-TERM USES OF NATURAL ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.001 Corps of Engineers maintenance activities in Grand Traverse Bay Harbor are conducted by Congressional authority in response to expressed and implied public need for continued small craft navigation and safety requirements within the project area. Breakwater repair and inner basin dredging is performed on a periodic basis as needed, in response to changing harbor use patterns and in response to storm-generated breakwater damage and basin shoaling.

7.002 In pursuit of the requirements for harbor maintenance, some localized short-term expenditures of funds, manpower, and natural resources have occurred. Localized short-term disruptions of the benthic biological community have occurred, however, no apparent long-term damage to any ecosystem has resulted from past Corps dredging or structure maintenance within the harbor.

7.003 The breakwater structures, as a result of their physical location and structural design, appear to be functioning as a groin, interrupting the shore building materials normally carried by littoral currents. This is resulting in an extensive loss of the shoreline south of the Corps project. The eventual loss of land, private dwellings, and public roads may become very costly in terms of monetary and aesthetic values unless abatement measures are taken. Studies are presently underway to determine the exact effect of the breakwater on shoreline processes and to find solutions to the erosion problem.

7.004 Some localized short-term releases of potential contaminants to the open waters of Lake Superior have occurred in the past during disposal of material dredged from the harbor; however, no apparent long-term damage to any ecosystem has resulted from past open lake dredged material disposal methods.

7.005 Corps maintenance activity and the periodic expenditure of funds, manpower and natural resources associated with that activity has permitted the continued use of Grand Traverse Bay Harbor by those individuals who rely on the harbor for their livelihood, for their recreation, and for their safety.

7.006 Continued maintenance of the Grand Traverse Bay Harbor, while resulting in irretrievable short-term uses and commitments of resources and temporary disruption of harbor benthic species within the project area, would allow the existence of harbor-related land use and life style options for present and future generations in the Grand Traverse area and surrounding Keweenaw Peninsula area.

8.000 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

8.100 Breakwater Maintenance - Breakwaters and revetments at Grand Traverse Bay Harbor are constructed of sheet piling, rock and concrete. All of the materials that go into either the construction or maintenance of any Corps of Engineers structures may be considered as permanently and irretrievably committed. All fuels and lubricating oils used by construction and maintenance machinery also constitute irretrievable commitments of natural resources.

8.200 Maintenance Dredging - The operation of dredging equipment, tugboats, tenders and other maintenance craft results in consumption of thousands of gallons of petroleum products each year, but only a portion of these are used at Grand Traverse Bay Harbor. Maintenance dredging entails an irreversible commitment of biological resources throughout much of the harbor as a result of alteration and disturbance of bottom sediments.

8.300 Dredge Material Disposal.

8.310 Open Lake - Past operations have disposed of approximately 174,866 cubic yards of sand, silt, clay and organic material dredged from the harbor over the life of the project into Lake Superior. Of that material only the sand, which made up the predominant character of the material, could be considered as a valuable natural resource which has for the most part been irretrievably lost.

8.320 Beach Nourishment - At various times in the past, dredged sand has been used as beach nourishment. Material used for beach nourishment represented a wise recycling of a valuable natural resource, as well as a replacement of real property and associated lakeshore land values.

8.400 Long-Term Commitments of Resources - Certain irreversible and irretrievable commitments of resources associated with Grand Traverse Bay Harbor maintenance must be viewed in light of the long-term public good, public need, and public safety afforded by a harbor in this location.

8.401 Corps of Engineers maintenance activity in Grand Traverse Bay Harbor permits both recreational boating and commercial fishing activity to be pursued by those persons who have chosen this harbor as their home port. In addition, the existence of the harbor increases the viability of the harbor-of-refuge program along Michigan's Keweenaw Peninsula.

9.000 COORDINATION

9.001 This report was drawn in part from an environmental impact assessment prepared by National Biocentric, Inc., and a shoreline process study prepared by Michigan Technological University, both under contract with the Corps of Engineers. Many meetings were held with National Biocentric, Inc. and its subcontractors; the University of Minnesota, Duluth; University of Wisconsin, Superior; and Michigan Technological University, Houghton, to determine the scope and content of the assessment and to ensure adequate coverage of all Corps functions and their effect on Grand Traverse Bay Harbor.

9.002 During the weeks of 9-13 and 16-19 of July 1973, representatives of National Biocentric, Inc., the Corps of Engineers, St. Paul District and Duluth; the U.S. Environmental Protection Agency; the Fish and Wildlife Service; the Minnesota Pollution Control Agency; the Minnesota, Wisconsin and Michigan Departments of Natural Resources; as well as local administrative officials and interested parties, participated in a tour of all harbors on Lake Superior which are within the jurisdiction of the St. Paul District of the Corps of Engineers. The purpose of the tour was to familiarize the representatives of interested Federal, State and local governments and of the contracting agencies who were carrying out technical studies on specific harbors with all of the harbors and the problems involved, in dredging, disposal and general maintenance of such harbors. It was hoped that as a result, the assessment parameters would be better understood by all and that a coordination of effort might better be achieved.

9.003 In addition, copies of this environmental assessment report have been furnished to the following agencies and interest groups:

U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Health, Education and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
U.S. Department of Transportation
Advisory Council on Historic Preservation
Federal Energy Administration

Michigan Advisory Council for Environmental Quality
Michigan Bureau of Management and Budget
Michigan Bureau of Programs and Budget
Michigan Department of Natural Resources
Michigan Farmers Home Administration

Michigan Historic Preservation Officer
Michigan State Archaeologist
Michigan Water Resources Commission
Great Lakes Basin Commission
Upper Great Lakes Regional Commission
Western Upper Peninsula Planning and Development

Izaak Walton League of America
League of Women Voters
Michigan United Conservation Clubs
Northern Environmental Council
Save Lake Superior Association
Sierra Club

Department of Biological Science, Michigan Technological University
Department of Civil Engineering, Michigan Technological University
Fresh Water Biological Institute, University of Minnesota
Marine Studies Center, University of Wisconsin
Social Science Division, Northern Michigan University
Michigan State Archives Library

10.000 CONCLUSIONS

10.001 Based on the information contained in this assessment report, I conclude that the continued operation and maintenance of Grand Traverse Bay Harbor is important to the health, safety, and social well-being of the residents of the local area and other persons utilizing the facility as a harbor-of-refuge. The adverse impacts of operation and maintenance activities are generally short-term in nature and the social benefits resulting from the project outweigh these short-term effects.

10.002 Attention should continue to be given to preventing, controlling, and removing any fuel spillage or oil slicks caused by dredging and harbor maintenance activities. Efforts should continue to be made to avoid spillage of sediment back into the harbor during dredging, loading and unloading of scows, cleaning of scows, and related activities.

10.003 The proposed action would not result in the displacement of any persons or in the loss of any known cultural, natural, historic, or archaeological resources. Any historical and archaeological finds made during dredging and harbor maintenance activities will be recorded and preserved. Coordination to determine the impact of Corps activities on a historical fishing community in the Grand Traverse Bay area has been initiated and further assessment will be made following the completion of coordination.

10.004 All maintenance work will continue to be coordinated with the U.S. Fish and Wildlife Service and the Michigan Department of Natural Resources to assure that the impacts upon aquatic life will be kept to a minimum.

10.005 The ongoing shoreline erosion study will be carried out to a reasonable conclusion and mitigative measures will be taken if necessary.

10.006 The environmental review by this office has indicated that the proposed action would not have a significant impact on the quality of the human environment.

10.007 Therefore, I conclude that these activities do not constitute a major Federal action which would significantly affect the quality of the human environment and it is my decision that an environmental impact statement will not be prepared for this activity.

30 May 1975

MAX W. NOAH
Colonel, Corps of Engineers
District Engineer

TECHNICAL

APPENDIX

ST. PAUL DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

ENVIRONMENTAL ASSESSMENT REPORT
OPERATION AND MAINTENANCE ACTIVITIFS
GRAND TRAVERSE BAY HARBOR
HOUGHTON COUNTY, MICHIGAN
LAKE SUPERIOR

TECHNICAL APPENDIX

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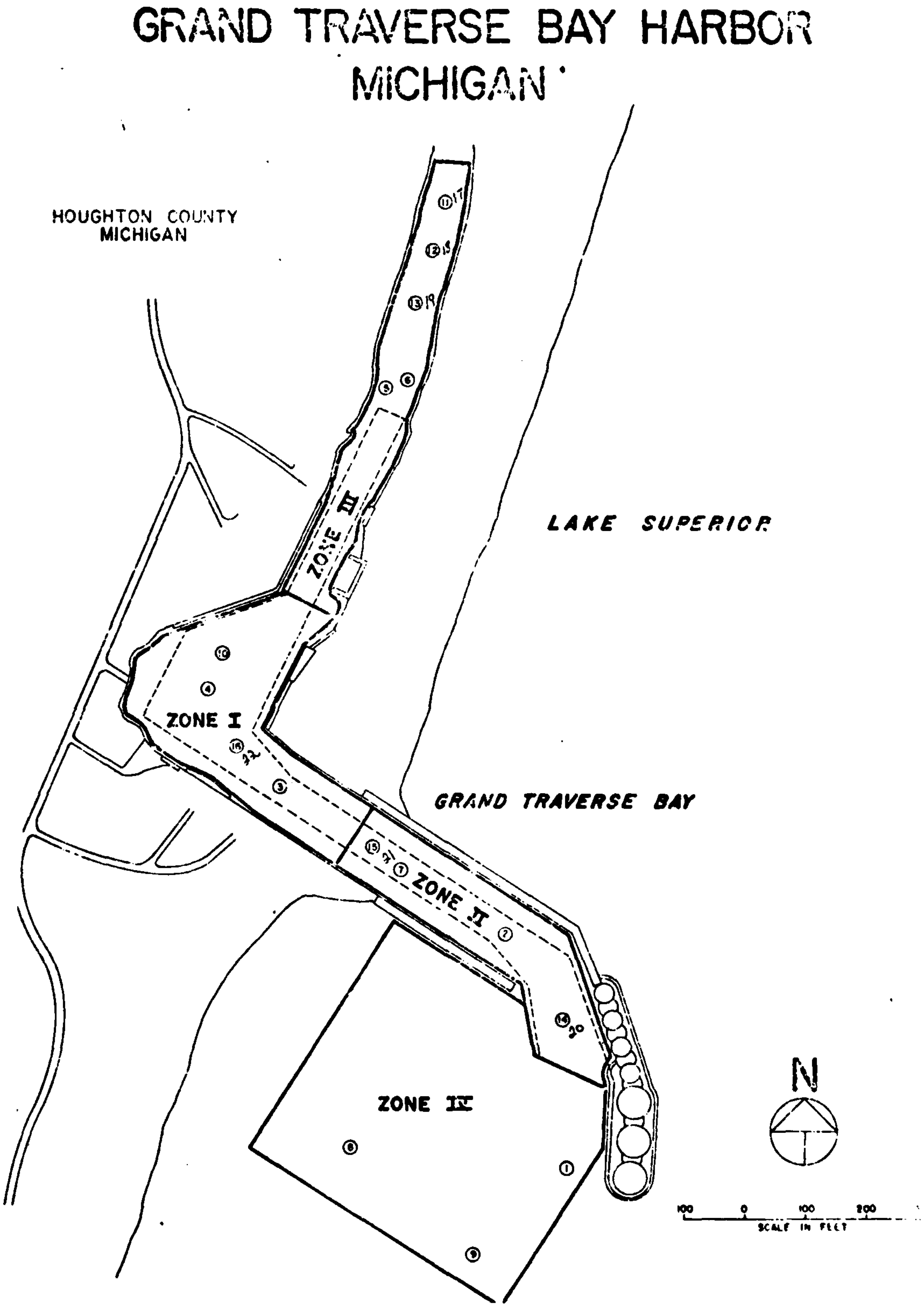

GRAND TRAVERSE BAY HARBOR ZONES

EXHIBIT 1

Table 1. The identification of specific samples within a zone in Grand Traverse Harbor

ZONE	SAMPLE NUMBER	DATE COLLECTED	AGENCY
1	3	November 1972	NBI
1	4	November 1972	NBI
1	10	July 1973	NBI
1	16	June 1973	MTU
1	22	August 1973	MTU
2	2	April 1971	EPA
2	7	July 1973	NBI
2	14	June 1973	MTU
2	15	June 1973	MTU
2	20	August 1973	MTU
2	21	August 1973	MTU
3	5	November 1973	NBI
3	6	November 1973	NBI
3	11	June 1973	MTU
3	12	June 1973	MTU
3	13	June 1973	MTU
3	17	August 1973	MTU
3	18	August 1973	MTU
3	19	August 1973	MTU
4	1	April 1971	EPA
4	8	July 1973	NBI
4	9	July 1973	NBI

Table 2. Samples collected by EPA, NBI, and MTU in Grand Traverse Harbor.

Sample Number	Collecting Agency	Date Collected
1-2	EPA	April, 1971
3-6	NBI	November, 1972
7-10	NBI	July, 1973
11-16	MTU	June, 1973
17-22	MTU	August, 1973

EXHIBIT 2

GRAND TRAVERSE BAY HARBOR
WATER QUALITY SAMPLING DATA

Evaluation Parameters	SAMPLE 1	2	3	4	5	6	7
Volatile Solids (%)	0.0	0.0	.8	6.4	.3	.3	.9
Oil & Grease (mg/kg)	101	34	571	364	141	100	3670
C.O.D. (mg/kg)	4200	11500	9810	17300	13500	15800	7220
T. Nitrogen (mg/kg)			272	400	178	166	465
T. Phosphorus (mg/kg)	194	226	2460	358	2220	225	203
pH							7.0
Arsenic (mg/kg)	1.00	2.00					.60
Cadmium (mg/kg)	3.00	3.40	0.00	0.00	0.00	0.00	9.20
Copper (mg/kg)	79.00	162.00	109.00	31.80	12.20	16.70	84.30
Lead (mg/kg)	26.00	29.00	15.60	21.70	11.00	11.40	4.30
Mercury (mg/kg)	.30	.30					.90
Zinc (mg/kg)	18.00	28.00	164.40	116.00	32.00	15.10	28.00
Particle Size (%)							
30			1.6	11.0	16.4	62.2	.3
100			53.2	66.6	82.3	37.5	81.8
230			39.6	19.0	.8	.2	16.3
325			5.4	3.2	.4	.1	1.3
PAN			.2	.2	.1	0.0	.3

Table 3. Results of laboratory analysis of bottom sediment samples collected in Grand Traverse Bay by EPA, [illegible], and [illegible].

Evaluation Parameters	8	9	10	11	12	13	14
	SAMPLE						
Volatile Solids (%)	.9	.2	45.2	.2	.5	.2	.1
Oil & Grease (mg/kg)	6380	3000	27200	809		243	0
C.O.D. (mg/kg)	7820	1890	590000	2900	3530	1650	170
T. Nitrogen (mg/kg)	392	289	6080	290	258	192	204
T. Phosphorus (mg/kg)	186	134	794	19	16	6	5.2
pH	7.1	7.5	6.4	5.9	7.2	6.2	7.8
Arsenic (mg/kg)	1.40	.20	.20	<.5	.6	1.1	<.5
Cadmium (mg/kg)	7.10	9.40	3.10	23	167	13	85
Copper (mg/kg)	262.00	29.00	204.00	12.3	24.5	13.4	10.1
Lead (mg/kg)	5.40	3.40		<.10	<.10	<.10	.65
Mercury (mg/kg)	.20	.20	.80	9.1	85.9	8.9	32.9
Zinc (mg/kg)	62.60	15.20	19.40	5.3	44.8	40.0	.2
Particle Size (%)							
30	.1	4.8	21.8	90.8	51.1	59.1	88.9
100	49.9	85.8	44.4	3.4	1.2	.7	8.5
230	45.1	8.6	26.4	.4	.7	.1	1.2
325	4.5	.7	6.5	.1	2.2	.1	1.0
PAN							

Table 3. Results of laboratory analysis of bottom sediment samples collected in Grand Traverse Bay by EPA, NBI, and MTU continued.

Evaluation Parameters	SAMPLE 15	16	17	18	19	20	21	22
Volatile Solids (%)	2.0	.5	.1	0	0	.3	1.4	
Oil & Grease (mg/kg)	849		750		1030	520		470
C.O.D. (mg/kg)	1380	2080	1960		230	1690	7660	
T. Nitrogen (mg/kg)	259	225	59	125	175	205	162	141
T. Phosphorus (mg/kg)	13	14		70	54	60	36	8
pH	6.5	6.5	6.4	6.1	6.3	6.8	6.6	6.2
Arsenic (mg/kg)	.4	.3	.10	.05	.10	.10	.11	.10
Cadmium (mg/kg)	<.5	.6	1.1	<.5	<.5	1.1		
Copper (mg/kg)	61	22	7.2	11.1	14.70	37.6	78.3	
Lead (mg/kg)	18.3	17.6	<8	8.2	<8	9.1	<8	
Mercury (mg/kg)	.29	.17	<.10	<.10	<.10	<.10	<.10	
Zinc (mg/kg)	21.0	18.3	4.50	5	5.30	4.80	18.90	
Particle Size (%)								
30	8.5	26.2	30.1	40.9	59.7	0	1.1	
100	70.1	52.1	68.0	58.4	40	82.9	40.5	
230	15.7	17.1	1.7	.3	.1	15.6	41.1	
325	3.6	3.1	0	0	0	.8	11.4	
PAN	2.1	1.5	.2	.4	.2	.7	5.9	

Table 3. Results of laboratory analysis of bottom sediment samples collected in Grand Traverse Bay by EPA, NBI AND MSU. (continued.)

Evaluation Parameter	SAMPLE S 11	S 12	S 13	S 14	S 15	S 16	S 17
Dissolved O_2 (ppm)	8.4	8.4	8.8	9.0	8.9	8.4	
Temperature (°C)	11.0	11.0	11.0	10.5	10.5	11.0	17.5
pH	6.9	7.0	6.6	7.0	6.9	6.9	
Turbidity (JTU)	1.2	1.2	1.2	2.0	1.8	1.6	
Conductivity (μ Siemens) (25 C)	57	59	60	66	62	62	
Alkalinity (ppm)	51	48	51	59	62	62	
T. Nitrogen (ppm)	1.1	1.6	1.1	1.0	1.1	1.4	
T. Phosphorus (ppm)	.058	.018	.032	.040	.088	.058	.092
Mercury (ppm)	<.001	<.001	.005	<.001	<.001	.002	<.001
Lead (ppm)	<.04	<.04	<.04	<.04	<.04	<.04	<.04
Zinc (ppm)	.020	.010	.023	.017	.010	.019	
Cadmium (ppm)	<.005	<.005	<.005	<.005	<.005	<.005	<.005
Copper (ppm)	.016	.016	.014	.028	.024	.020	
Arsenic (ppm)	<.007	<.007	<.007	<.007	<.007	<.007	<.007

Table 4. Results of laboratory analysis of water samples collected in Grand Traverse Bay by MTU and NBI. S = sample collected one meter below the water surface, B = sample collected one meter above the bottom.

Evaluation Parameter	SAMPLE S_{18}	S_{19}	S_{20}	S_{21}	S_{22}
Dissolved O_2 (ppm)			10.1	9.0	9.1
Temperature (°C)	17.5	18.0	16.0	16.0	16.1
pH			7.4	7.2	6.8
Turbidity (JTU)			.6	.5	1.1
Conductivity (μ Siemens) (25 C)			73	73	65
Alkalinity (ppm)			40	36	31
T. Nitrogen (ppm)			1.100	.900	.800
T. Phosphorus (ppm)	.058	.092	.040	.088	.058
Mercury (ppm)	<.001	<.001	<.001	<.001	<.001
Lead (ppm)	<.04	<.04	<.04	<.04	<.04
Zinc (ppm)			.021	.021	.021
Cadmium (ppm)	<.005	<.005	<.005	<.005	<.005
Copper (ppm)			<.010	<.010	.013
Arsenic (ppm)	<.007	<.007	<.007	<.007	<.007

Table 4. Results of laboratory analysis of water samples collected in Grand Traverse Bay by MTU and NBI. S = sample collected one meter below the water surface, B = sample collected one meter above the bottom.

Evaluation Parameter	SAMPLE B_3	B_4	B_5	B_6	B_7	B_8	B_9
Dissolved O_2 (ppm)					10.0	10.2	10.2
Temperature (°C)	1.0	1.0	1.0	1.0	12.0	12.0	13.0
pH	7.0	7.1	6.7	6.7	8.0	8.1	8.1
Turbidity (JTU)	2.2	2.5	2.2	2.5	2.7	3.8	4.5
Conductivity (μ Siemens) (25 C)	45	45	32	32			
Alkalinity (ppm)	70	56	84	78	48	52	49
T. Nitrogen (ppm)	.410	.120	.120	.120	.570	.519	.553
T. Phosphorus (ppm)	.790	.850	1.600	1.510	.011	.001	.001
Mercury (ppm)							
Lead (ppm)							
Zinc (ppm)							
Cadmium (ppm)							
Copper (ppm)							
Arsenic (ppm)							

Table 4. Results of laboratory analysis of water samples collected in Grand Traverse Bay by MTU and NBI. S= sample collected one meter below the water surface, b = sample collected one meter above the bottom.

Evaluation Parameter	SAMPLE B 10	B 11	B 12	B 13	B 14	B 15	B 16
Dissolved O_2 (ppm)	10.0	8.6	8.8	8.6	8.8	9.3	8.8
Temperature (°C)	12.0	11.0	11.0	11.0	7.5	9.3	9.5
pH	8.0	6.6	6.9	6.9	6.9	6.8	6.9
Turbidity (JTU)	5.1	1.2	1.2	2.1	2.0	2.1	1.9
Conductivity (µ Siemens) (25 C)		57	62	64	68	70	64
Alkalinity (ppm)	51	51	51	48	44	48	48
T. Nitrogen (ppm)	.855	1.4	1.6	1.0	.9	1.1	1.1
T. Phosphorus (ppm)	.038	.088	.098	.040	.040	.088	.046
Mercury (ppm)		<.001	<.001	<.001	<.001	<.001	<.001
Lead (ppm)		<.04	<.04	<.04	<.04	<.04	<.04
Zinc (ppm)		.020	.020	.026	.017	.013	.017
Cadmium (ppm)		<.005	<.005	<.005	.008	<.005	<.005
Copper (ppm)		.016	.016	.054	.033	.024	.024
Arsenic (ppm)		<.007	.007	<.007	<.007	<.007	<.007

Table 4. Results of laboratory analysis of water samples collected in Grand Traverse Bay by MTU and NBI. S = sample collected one meter below the water surface, B = sample collected one meter above the bottom.

Evaluation Parameter	SAMPLE B 17	B 18	B 19	B 20	B 21	B 22
Dissolved O_2 (ppm)	9.2	8.2	7.0	9.0	9.5	8.8
Temperature (°C)	17.5	17.3	17.5	14.8	12.0	12.0
pH	6.5	6.5	6.6	7.4	7.2	6.8
Turbidity (JTU)	2.1	2.2	2.1	0.3	1.0	1.0
Conductivity (µ Siemens) (25 C)	57	56	55	73	72	80
Alkalinity (ppm)	24	28	24	39	34	31
T. Nitrogen (ppm)	1.100	.800	.900	1.100	1.030	1.200
T. Phosphorus (ppm)	.092	.140	.088	.092	.135	.098
Mercury (ppm)	<.001	<.001	<.001	<.001	<.001	<.001
Lead (ppm)	<.04	<.04	<.04	<.04	<.04	<.04
Zinc (ppm)	.031	.054	.026	.020	.020	.026
Cadmium (ppm)	<.005	<.005	<.005	<.005	.007	<.005
Copper (ppm)	.010	.052	.024	.010	<.010	.010
Arsenic (ppm)	<.007	<.007	<.007	<.007	<.007	<.007

Table 4. Results of laboratory analysis of water samples collected in Grand traverse Bay by MTU and NBI. S = sample collected one meter below the water surface, B = sample collected one meter above the bottom.

Bacteriological analysis of water samples from Grand Traverse, collected by MTU* in the summer of 1973. Surface samples (S) and bottom samples (B) were collected one meter below the surface and one meter above the bottom.

Sample	Zone	Date	Total Coliforms	Fecal Coliforms
16S	1	6/73	150	15
16B	1	6/73	150	15
22S	1	8/73	150	23
22B	1	8/73	1100	15
14S	2	6/73	21	23
14B	2	6/73	36	23
20S	2	8/73	15	9
20B	2	8/73	11	4
15S	2	6/73	20	15
15B	2	6/73	240	9
21S	2	8/73	23	7
21S	2	8/73	93	91
11S	3	6/73	75	23
11B	3	6/73	36	15
17S	3	8/73	11	150
17B	3	8/73	---*	---*
12S	3	6/73	93	7
12B	3	6/73	---*	---*
18S	3	8/73	21	460
18B	3	8/73	---*	---*
13S	3	6/73	460	43
13B	3	6/73	---*	---*
19S	3	8/73	75	43
19B	3	8/73	---*	---*

* Too shallow for bottom samples

Benthic Invertebrates Collected by MTU and NBI with a nine inch x nine inch Ponar Dredge at Grand Traverse.

Sample Number	Organism	Number Present
3	Procladius	2
3	Rheotanytarsus	1
3	Peloscolex	3
3	Lumbriculus	1
4	Lumbriculus	5
4	Tubifex	1
4	Chaetogaster	1
4	Dasyhelea	1
5	Unidentified Tanypodinae	1
5	Lumbriculus	1
6	Palponyia	2
7	Peloscolex	2
7	Lumbriculus	2
7	Limnodrilus	1
7	Tubifex	1
8	Unidentified Chironomid	1
9	Eukiefferiella	1
9	Unidentified Chironomid	1
10	Rhizelmis	1
10	Peloscolex	24
10	Limnodrilus	164
10	Lumbriculus	127
10	Tribelos	1
11	Diamesa	1
12	No Organisms	
13	No Organisms	
14	Peloscolex	1
15	Eukiefferiella	2
15	Unidentified Chironomids	3

EXHIBIT 4

GRAND TRAVERSE BAY HARBOR
BENTHIC INVERTEBRATE SAMPLING

Grand Traverse Continued.

Sample Number	Organism	Number Present
16	Eukiefcriella	1
16	Tribelos	2
16	Peloscolex	7
16	Palponyia	1
17	Eukiefferiella	4
17	Tribelos	3
17	Unidentified Chironomids	4
17	Limnodrilus	1
17	Palpomyia	5
18	Palpomyia	4
18	Diptera pupa	1
19	Cryptochironomus	1
19	Heterotrissocladius	3
19	Rheotanytarsus	1
19	Palpomyia	1
19	Hydropsychidae	1
20	Eukiefferiella	3
20	Unidentified Chironomid	2
21	Eukiefferiella	1
21	Tubifex	3
21	Lumbriculus	2
22	Eukiefferiella	1
22	Heterotrissocladius	2
22	Polypedilum	2
22	Lumbriculus	1
22	Sialis	1

Phytoplankton and zooplankton collected at Grand Traverse Bay Harbor in the summer of 1973 by MTU. Those organisms listed below "* =" are considered to be zooplankton.

14

	#/1
Synedra	1950
Cymbella	500
Tabellaria	750
Navicula	900
Diatoma	900
Oedogonium	300
Scenedesmus	150
Asterionella	300
Dinobryon	300
Cyclotella	150
Cocconeis	150
Mougeotia	300
Ceratoneis	150
* =	
Copepod exoskeleton	150

15

	#/1
Asterionella	1150
Tabellaria	580
Navicula	460
Cymbella	350
Synedra	350
Achnanthes	350
Scenedesmus	110
Stauroneis	110
Diatoma	230
Dinobryon	110

16

	#/1
Asterionella	1490
Navicula	600
Cymbella	400
Tabellaria	500
Synedra	500
Diatoma	200
Eunotia	100
Stauroneis	100
Gomphoneis	100
Stigeoclonium	100
Anabaena	200
Dinobryon	100
Cocconeis	100

17

	#/1
Navicula	3510
Asterionella	4510
Tabellaria	3010
Dinobryon	1520
Synedra	1000
Cymbella	500
[illegible]	500
Stephanodiscus	500
Diatoma	500

18

	#/1
Asterionella	8770
Tabellaria	1870
Diatoma	2310
Scenedesmus	460
Stauroneis	460
Navicula	460
Cymbella	460
Oscillatoria	460
Dinobryon	460
Closterium	460
Eunotia	460
* =	
Trachelomonas	460

19

	#/1
Asterionella	4110
Diatoma	2240
Navicula	1490
Tabellaria	1870
Synedra	1490
Mougeotia	750
Achnanthes	370
Meridion	370
Gomphoneis	370
Amphora	370
Anabaena	370
Nitzchia	370

EXHIBIT 5

GRAND TRAVERSE BAY HARBOR
PHYTOPLANKTON & ZOOPLANKTON SAMPLING

Phytoplankton and zooplankton collected at Grand Traverse Bay Harbor in the summer of 1973 by MTU. Those organisms listed below "* =" are considered to be zooplankton.

20

	#/1
Dinobryon	1270
Asterionella	960
Rhizosolenia	960
Glaucocystis	640
Synedra	320
Arthrospira	160
Fragilaria	160
Diatoma	160
Chrysosphaerella	320
* =	
Daphnia	160
Cyclops	160
Daphnia brood case	160

21

	#/1
Asterionella	720
Tabellaria	510
Microsterias	100
Rhizosolenia	100
Fragilaria	200
Synedra	100
Glaucocystis	100
* =	
Kellicottia	100
Cyclops	100
Daphnia	100
Unknown nauplius larva	100

22

	#/1
Synedra	490
Tabellaria	490
Rhizosolenia	490
Asterionella	390
Mougeotia	100
Arthrospira	100
Fragilaria	200
Chrysosphaerella	100
Dinobryon	100
Amphora	100

23

	#/1
Asterionella	950
Mougeotia	640
Tabellaria	640
Dinobryon	320
Oscillatoria	320
* =	
Ceratium	320

24

	#/1
Tabellaria	920
Diatoma	920
Mougeotia	920
Synedra	460
Cocconeis	460
* =	
Daphnia exoskeleton	460

25

	#/1
Mougeotia	1560
Tabellaria	940
Gomphonema	1250
Diatoma	310
Stigeoclonium	310
Chrysosphaerella	310

DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

NCSED-ER

4 December 1975

Mr. James Fitting
State Archaeologist
Department of Natural Resources
Stevens T. Mason Building
Lansing, Michigan 48926

Dear Mr. Fitting:

We are now in the process of preparing a draft environmental impact statement for the operation and maintenance of Grand Traverse Bay Harbor, Houghton County, Michigan and for harbor related shoreline erosion.

In general the statement will discuss the environmental impacts of Corps of Engineers activities necessary to maintain and operate the harbor. This involves normal breakwater repair and maintenance dredging which is performed as needed. The Corps removes an estimated annual average of 3,000 cubic yards. Dredged material from Grand Traverse Bay Harbor is disposed of in the open lake or near shore as beach nourishment.

In compliance with section 106 of the National Historic Preservation Act of 1966 and Executive Order 11593, we are requesting your comments concerning the existence of any historical, archeological and paleontological resources which may exist in the vicinity of Grand Traverse Bay Harbor, and which may be affected by operation and maintenance activities. Two plates are inclosed indicating the location of the harbor and the project dimensions.

The draft environmental impact statement for Grand Traverse Bay Harbor is scheduled for completion in the Spring of 1976, and a copy will be furnished you at that time.

If we can be of any further assistance please contact us.

Sincerely yours,

Incls.
1. Index Map - Lake Superior Projects
2. Index Map - Grand Traverse Bay Harbor, Michigan

MAX W. NOAH
Colonel, Corps of Engineers
District Engineer

IDENTICAL LETTERS TO:

Mr. Wilfred M. Husted
Archaeologic Salvage Coordinator
National Park Service
U.S. Department of the Interior
143 South 3rd Street
Philadelphia, Pennsylvania 19106

Mr. James Fitting
State Archaeologist
Department of Natural Resources
Stevens T. Mason Building
Lansing, Michigan 48926

Dr. Martha M. Bigelow
Division of Michigan History
Department of Natural Resources
208 North Capitol Avenue
Mutual Building
Lansing, Michigan 48933

United States Department of the Interior

NATIONAL PARK SERVICE
MIDWEST REGION
1709 JACKSON STREET
OMAHA, NEBRASKA 68102

IN REPLY REFER TO:

L7619 MWR CE

JAN 9 1975

Colonel Max W. Noah
Corps of Engineers
District Engineer
1210 U.S. Post Office
St. Paul, Minnesota 55101

Dear Colonel Noah:

Major Hintz's letter of December 4, 1974, to Mr. Wilfred Husted in our Philadelphia Office has been forwarded to our office for reply. We have been requested to comment on any historical, archeological, and paleontological resources known to exist in the vicinity of Grand Traverse Bay Harbor, Michigan, which may be affected by your operation and maintenance activities.

Although records available to us do not indicate that any cultural resources are present in the area described, we cannot make the type of field reconnaissance needed to provide the assurance you seek that the action proposed would have no impact on cultural resources. Therefore, we can only suggest sources for such information as will be necessary for compilation of the draft environmental statement.

The statement should reflect consultation of the National Register of Historic Places (including monthly supplements as published in the Federal Register) in order to determine whether any properties listed therein will be affected in any way by the proposed plan for operation and maintenance of Grand Traverse Bay Harbor. If the project has an effect on a National Register listing, the statement should reflect further compliance with Section 106 of the National Historic Preservation Act of 1966 (Public Law 89-665). Evidence of consultation with the State Historic Preservation Officer should also be presented with respect to cultural values in the project area that may be eligible for inclusion in the National Register.

JOHNNY HORIZON
76

Let's Clean Up America For Our 200th Birthday

EXHIBIT 7

LETTER FROM THE
NATIONAL PARK SERVICE

In the event that the proposed project entails involvement of any onshore properties, the Michigan State Archaeologist (Dr. James E. Fitting, Michigan History Division, Department of State, 208 North Capitol Avenue, Lansing, Michigan 58918) should be contacted with regard to any archeological resources within the project area which may be affected by the proposed project. If there are no cultural resources known at the present time within affected onshore areas, it may be necessary to conduct a professional archeological survey of all lands to be directly affected by the proposed project in order to locate and assess presently unrecorded archeological resources.

The statement should further reflect procedures to be followed should previously unknown archeological resources be encountered during project development.

Sincerely yours,

Robert L. Giles

Robert L. Giles
Acting Regional Director

MICHIGAN DEPARTMENT OF STATE
RICHARD H. AUSTIN SECRETARY OF STATE

LANSING
MICHIGAN 48918
(517) 373-0510
MICHIGAN HISTORY DIVISION
ADMINISTRATION, PUBLICATIONS
RESEARCH, AND HISTORIC SITES
208 N. Capitol Avenue
STATE ARCHIVES
3405 N. Logan Street
STATE MUSEUM
505 N. Washington Avenue

December 17, 1974

Colonel Max W. Noah
Army Corps of Engineers
1210 U.S. Post Office and Customs House
St. Paul, Minnesota 55101

Dear Colonel Noah:

We have no record of archaeological sites within the immediate area of Grand Traverse Harbor, Houghton County, Michigan. Furthermore, the proposed dredging, including offshore dumping of a limited amount of dredgings, would have no adverse impact on such unrecorded sites as might exist in the area.

I would like to call your attention to a study of this area that will be included in a Master's Thesis being prepared by Mr. Alan Moore for the School of Natural Resources at the University of Michigan. The Grand Traverse Fishing Community has been identified as one of the six most significant historical fishing communities in the State. Moore is to join our staff in February, 1975 and the entire area will probably be nominated to the National Register of Historic Sites at that time. Since I am not a historian, I will not attempt to assess the impact of your actions on the historical integrity of the district.

Sincerely,

James E. Fitting
James E. Fitting
State Archaeologist
Michigan History Division

JEF/cw

cc: M. Bigelow
K. Eckert

EXHIBIT 8 LETTER FROM THE MICHIGAN STATE ARCHAEOLOGIST

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
1135 U. S. POST OFFICE & CUSTOM HOUSE
ST. PAUL, MINNESOTA 55101

IN REPLY REFER TO
NCSED-ER

16 May 1975

Dr. Martha M. Bigelow
State Preservation Officer
Michigan History Division
208 North Capitol Avenue
Lansing, Michigan 48918

Dear Dr. Bigelow:

We are now preparing an environmental assessment report for operation and maintenance activities in Grand Traverse Bay Harbor, Houghton County, Michigan.

In general, the statement will discuss the environmental effects of Corps of Engineers activities necessary to maintain and operate the harbor. This involves breakwater repair and maintenance dredging which are performed as needed. The Corps removes an estimated average of 3,000 cubic yards of bottom sediment annually. Dredged material is disposed of in the open lake or near shore as beach nourishment.

In compliance with section 106 of the National Historic Preservation Act of 1966 and Executive Order 11593, we are requesting your comments concerning the existence of any historical, archaeological and paleontological resources which may exist in the vicinity of Grand Traverse Bay Harbor, and which may be affected by operation and maintenance activities. Of particular concern at this time, is the status and location of the recently identified Grand Traverse Fishing Community which was brought to our attention by Dr. James E. Fitting in his letter of 17 December 1974. Two plates are inclosed indicating the location of the harbor and the project dimensions.

The environmental assessment report for Grand Traverse Bay Harbor is scheduled for completion in May 1975, and a copy will be furnished you at that time.

If we can be of further assistance, please contact this office.

Sincerely yours,

MAX W. NOAH
Colonel, Corps of Engineers
District Engineer

2 Incls
1. Index Map - Lake Superior Projects
2. Index Map - Grand Traverse Bay Harbor, Michigan

LETTER TO THE MICHIGAN STATE HISTORIC PRESERVATION OFFICER

EXHIBIT 9

END

FILMED